

Aviation Week

and Space Technology

15 Cents

A McGraw-Hill Publication

July 31, 1961

First Pictures
Of Lockheed's
Light Helicopter

Soviet Beauty Mach 2 Bomber



BY VOI-SHAN



MILSON® STRUCTURAL PANEL FASTENERS

William F. Holt, Center
State Savings
Knoxville, Tennessee

Subject: E-2020 Theology
Lent Reading
Matthew 26: 1-75

www.1000
Standard Curve
Data Sheet, 1/20/2011

© 1996 National
Farm Training
Institute, Inc.

Wilhelm VIII Brauerhof
 700 Lg. P.O. Box 10
 Annapolis

William Shaw
Philip Reed
Thomas Kelly

August 1978
 Publishing Unit
 News Staff

New Vol Shiro's three sizes bring all the advantages of Milner's Fasteners to almost any application that calls for quickly removable structural panels. Milner's Fasteners make the panel an integral part of the primary structure—yet permit fast, repeated access to equipment behind the panel. Vol Shiro's three structural sizes, $\frac{1}{2}$ " x $\frac{1}{2}$ " x $\frac{1}{4}$ ", two shank bolt head styles, five receptacle configurations, and two lip-capture rings permit maximum design flexibility.

Milner's Fasteners also come up to .125 in. wide (or less) for two-panel bolt installations. They're OK in Self-locks, too. They have one last trick, too.

low adhesion, and can be reused 350 or more times. Deep heat sealer provides quick tool insertion, high preload, superior power driving, and longest useful life. Milco Fasteners have common hole size in the panel and substructure and all parts are completely interchangeable, available in alloy steel for temperatures to 550°F, in corrosion resistant steel to 700°F, and with self-wiring receptacles.

For new brochures, further information, prices, and/or localized assistance on Milco and other quality fastener products, you are invited to contact Val Steel's Sales Service Department.

COMPARISON CHART

AGE	ADULTAGE	THREE YEARS	SEVEN YEARS	FIFTY YEARS
More 1200-4	370	2,050	1,000	650-750
MS 347-53	412	3,500	1,210	700
More 1200-6	412	4,200	3,500	875
MS 347-61	370	6,600	3,710	215
More 1200-6	370	8,800	3,800	10-1,000

^a The alloy steel has temperature up to 500 °F and maximum pressure up to 1000 psi.

* Heating about 100 mg material three separate times for 10 min each at 100°C. * Heating about 100 mg material three separate times for 10 min each at 100°C. * Heating about 100 mg material three separate times for 10 min each at 100°C.

© 2004 Blackwell Publishing Ltd *Journal of Internal Medicine* 255: 109–116

VOLSHAN MANUFACTURING COMPANY



4443 WILSONA STREET, CHS NEW YORK, CALIFORNIA



HYDRO-AIRE ADVANCED HYDRAULIC MOTORS PROVE RELIABILITY DRIVING FUEL PUMPS ON MACH 2+ F4H-1!



You can bet Acuborn will find good reasons to choose Hydro-Air hydraulic motors for this advanced application. The first is reliability resulting from optimum design simplicity and now proved both in flight and in extensive emission/marital tests. Others are reflected in the characteristics of this typical model: 68-359-079 (displacement: 0.0757 cu in. per rev) Torque: 30.4 lbf-in (2800 PSI inlet to outlet pressure differential and 12,000 rev./H₂O ratio 3:9:1. Life: 1200 hours. Write now for data sheets on available models and/or a prompt quote on your specifications.

WYKŁADY CHARAKTERYSTYCZNE. Wzrost w sposób istotny dla rozwoju





These are the three different temperature controls made by Magneti Cellosi Company for the Italian missile and rocket sub-systems.

4413 CAMBRIDGE STREET, ANNAPOLIS, MD. 20704 • WC: 2-4991

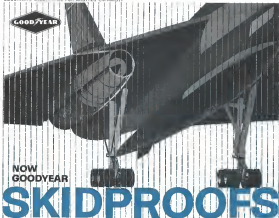
Heat Control Systems • Solar Inverters • Voltage Monitoring Systems

(Continued from page 5)

(Continued from page 5)

[illegible]

GOODMAN: SUFFICIENT FOR ANOTHER CAPABILITY



THE 16 MAINWHEEL TIRES ON THE B-58

To protect the bustling B-58 bomber against skid board, Goodgear engineered a lightweight (54 lbs) system that acts automatically to prevent skids before they start.

With high loading speeds common today, the need for positive, reliable shock protection is now critical. Goodway anti-shock systems rate preference because they're tailored to the operational characteristics of each circuit—they're neither "half" Horn nor make-shift jugs; they hardly shake up or free, and they can't be

Here's a sampling of the broad range of places whose builders trust an Goodren's "engineered" approach to steel protection:

Keywords: P-1000 — Specialized embedded systems

Lichtbild F-104 Drive— Gearbox system for ground-controlled drive automatically controls braking pressure.

Lockheed F-104 — Key factor in design was

Lockhead JetStar—This corporate transport will also allow small towns airports—making short-hauling run much faster in system design.

USAF EC-34—An autonomous multi-skill operator is planned to cover the full range of world-wide runway operating conditions for the next 10 years, says the service.

For details on Goodyear skid-protection systems, write on company

letterhead to The Goodyear Tire & Rubber Company, Aviation Products Division, Dept. G-1715, Akron, OH. Remember—lots of good things come from Goodyear.

SAF-WARNING SYSTEM® instantly "locks" pilot's foot when it hits pedals. Pilot controls the slide retraction control.

SAF-DECEL SYSTEM releases brake pressure automatically until skid decelerates to zero. Then it releases brake pressure.

Pilot-Selectable Landing combines first two types. Provides automatic parachute jettisoning pilot control when desired.

New Adaptive Brake Pressure Control maintains highest usable pressure before skid pedal regardless of canopy condition.

AVIATION PRODUCTS BY

GOOD YEAR

More Enroll Lead on Gasifier Trees, Wheat, and Soybean Than on Any Other Crop

PRODUCTS OF THE PIONEER IN MILITARY ELECTRONICS...

As a department of Fairchild's Defense Products Division, Du Mont Military Electronics provides acknowledged leadership in data acquisition, transmission and display, and support systems. These Du Mont talents have developed high resolution electronic imaging systems operating in the visual and near infrared portions of the spectrum, and from daylight illumination levels to overcast moonless nights. Electro-visual fire control, radar bore-sighting, missile guidance and space reconnaissance are typical applications. Millimeter wave radar for navigation, detection, tracking and ranging of surface and air targets is a specialized area of outstanding achievement. Rapid go-no-go electronic test equipment also has been designed and produced for operational

check-out of missile, drone and aircraft systems.

Whatever the environment or the requirement—the Du Mont Department offers over 25 years of experience as the pioneer in military electronics. For information or specifications, write the Marketing Manager, Du Mont Military Electronics Department, Defense Products Division, 730 Bloomfield Avenue, Clifton, New Jersey.



Engineers and Scientists are invited to discuss new opportunities presented by continuing growth of the Defense Products Division.



If a klystron lasts 20,000 hours before lying down on the job, it's exceptional.



If a klystron is still standing up after 50,000 hours, it's Eimac's.

Eimac's 3K50,900LF klystron is still going strong after six years of almost continuous operation. That's longer than most companies have been building klystrons. Not it's typical of the way Eimac designs them for peak performance, maximum life. For details on Eimac's complete line, write: Power Klystron Marketing, Ester-McCloughry, Inc., San Carlos, Calif.



INSTRUMENT FAILURE?

You're warned...

Instantly and Automatically!

The need was there. An instrument failure warning system had to be developed to monitor the navigation instruments and supply the vessel flag warning system and visible-voice alarm.

Fox American World Airways, recognizing this need, got the engineering problem in the hands of GEI. And from their drawing boards evolved the Electronic Navigation Instrument Failure Warning System.

After extensive trans-Atlantic tests aboard Fox Air's Boeing 707-321 Jet, this new system has been certificated by the FAA.

Now in full production at GEI, this system will, according to experts, make it possible to seek lower minimum visibility and ceiling and still add an immeasurable degree of safety to every flight.



GEI's Electronic Navigation Instrument Failure Warning System is always alerted to any electrical malfunction. If a malfunction does occur, an annunciator light, the master warning light flashes and a sounder emits an electro-mechanical thrumming, an attention-compelling but not annoying sound.

Pushing out a lighted annunciator cap disconnects the master warning light and sounder from this annunciator only, leaving the cap illuminated as long as the fault exists. The master light and sounder remain keyed to report any other malfunctions.

In the Fox American installation, the IGE, UCC and GE send a transmitter for both the Command and King Q-Three. The Command Annunciator Panel (including warning lights) has the compass indicator magnet and power failure is located between the two pilots.

If you would like full information on this revolutionary new warning device, write or call:

GABLES ENGINEERING, INC.

247 Essex Avenue, Cold Spring, New York, NY 10516



UNSEEN BUT NEVER LOST. Far down in the secret depths of the sea America's Polaris submarines can cruise for many weeks, poised for free world defense. Without surfacing, one of these submarines can pinpoint their exact position constantly. The equipment to perform this precise duty is called Mark II SWS (Ship's Inertial Navigation System). The first operational SWS was designed, built, and delivered in record time by Autonetics.

Electromechanical Systems by **Autonetics**



Division of North American Aviation



Laying It on the Line

President Kennedy's speech to the nation last week was an address that just had to be made at this particular time. It was directed to Nikita Khrushchev in much as to the American people, and it told him loudly and clearly that there must be an end to his policy of gobbling up new communist conquests or he must face the fact of war.

Three times in modern history major wars have begun because the great powers of Europe were content for the United States would not go to war, and three times there have been truces—in World War I and II and in Korea. Each time, a new delusion of United States policy before the war began, with a clear definition of the line beyond which this nation would not be pushed, might have discouraged the aggression that caused.

President Kennedy apparently is trying to avoid this possibility of miscalculation of our intention by communist leaders. In that task, he faces formidable problems because in many of our actions during the past few years have indicated to the Communists that we had become completely self-centered in our program of movement and couldn't care less about the troubles of people being crushed under the communist juggernaut in places where the geography was even more confusing to Americans than the politics. We think this has been a dangerous illusion for any aggression during the 20th century.

It is too bad that Mr. Khrushchev cannot consult Kaiser Wilhelm and the German field marshals of 1918 victory, Mussolini, Hitler, the Japanese, admirals of 1941 victory and his own predecessors and political tutors, Stalin, on how the American people surprised them by failing to attain their remote indifference when fully confronted by a naked threat to their security.

We think President Kennedy was reflecting the present mood of the American people when he drew the line last week beyond which we will not be pushed with out taking up arms against the pushers. Certainly major Americans who served in the European theater in World War II still retain the memory of the losses suffered by that conduct by the Germans in the 1939-45 war and may have an particular interest in deterring the perpetration of these crimes against humans from anybody. Recent reflections of the West German mood, with its U.S. financial prosperity and growing military strength, does not inspire any firm conviction that the Germans people learned any lesson from their World War II experience except to devote more effort to avoiding defeat. Our British allies have even fewer reasons about the current German temperament, and certainly the French must face the prospect of going to war over Berlin with much emotion.

But at this writing, both of these allies are standing firm and joining with the United States in drawing a clear and well defined line beyond which any communist advance means a shooting war.

It is ironic that it is Nikita Khrushchev himself who has excited most of this Western solidarity. As long as

he played the role of "Smash Uncle Sam," it was difficult for the West to carry a heavy arm burden with any grace. Many of our allies at one time or another sought relief from this load because there appeared to be no real threat on the eastern horizon. But since Mr. Khrushchev has taken to shoe pounding at the United Nations, rocket rattling in absent even major speech and denouncing to gather language in his descriptions of Western leaders, the naked hostility of the threat has become clear and the West is now standing firm more than at any time since the United Nations fought the communist bloc in Korea.

The inflation measures proposed by President Kennedy last week will boost the Fiscal 1962 defense budget to over \$47 billion. This will be a heavy but far from crushing burden on the American economy. Much of the new money requested will be devoted to plugging the gaps that have been allowed to develop in our defense structure during the years that we foolishly perceived the margin that any single weapon or single type of weapon could solve all our defense problems at bargain basement prices.

Certainly the mobility of our armed forces must be increased, as the President proposes, if we are to meet global commitments with sufficient resources in time to be effective against any possible enemy. Another point in the President's proposals that will meet little opposition is the attempt to stabilize the civil defense program on a realistic basis. Here the government has shirked its responsibility in a shameful manner during recent years in failing to provide the American people with realistic facts on the effects of nuclear weapons against their entire spectrum from the relatively low level of battlefield type weapons to the multi megaton (colossal) entered in ICBM warheads and bomb bags of heavy weight. This is another area where society has heart for more than it could possibly help.

We think, however, that there may be some dangerous illusion generated from the President's emphasis on building limited arm capability. There is no question that this capability must be strengthened to some degree and we must have new nuclear armaments in our arsenal, but it would be foolish to think we could meet the challenge of full-scale communist aggression with non-nuclear weapons no matter how much our capability in this field is bolstered in the future.

We will never be able to match the Russian leaders on the ground using only conventional weapons. If we are pushed into war, our only hope for victory will be in a devastating nuclear attack on the aggressor's homeland and sources of power.

That is a grim prospect. But viewing the Berlin crisis realistically, it is a prospect that cannot be faced freely if we are to achieve victory, in any struggle that may ensue. We can no longer afford to let our likelihood be drained slowly from every artery as we did in Korea. If the final test comes, we must commit our best resources to swift and decisive victory.

—Robert Hulse



Left: Shell engine tests in the Aeroflight Turbine Fuel Equipment Laboratory—first in the U.S. Right: New Lockheed jetliner tests. Shell sold over one billion gallons of aviation fuel last year.

Shell Research reports on 5 advances in fuels and lubricants and discloses how they improve aircraft performance

1. First sea-air additive oil for piston engine aircraft. AeroShell[®] Od W is the first fully compounded additive oil ever approved by every major piston engine manufacturer as the U.S. AeroShell Od W is the first piston engine oil that does not form harmful metal-rich deposits.

It helps keep engines cleaner, extends periods between overhauls, cuts areas lengthen engine life.

2. Shell grease lubricates X-15 as it sets world's speed record. Twenty-five greases were tested for use on the X-15 rocket plane. Only one—AeroShell Grease SA[®]—passed all tests and was commercially available.

Today, AeroShell Grease SA guards 25 vital control points in the X-15 as it sets new speed records for manned aircraft.

AeroShell Grease SA is also recommended for commercial and private aircraft.

3. Full-scale gas turbine research lab. Shell Research built and operated one of the petroleum industry's largest laboratories designed to investigate fuel performance in full-scale turbine engine combustion systems. This paid off in 1953 when the first turbine motor-

ized turbine aircraft, Shell was ready with the fuel.

Shell has the most extensive turbine fuel distribution network in the nation for general aviation and sold over a billion gallons of aviation fuel last year.

Today, Shell is the leading supplier of commercial aviation fuel in the U.S.

4. First turbine fuel equipment lab assures maximum cleanliness. Shell set up the first U.S. laboratory in the industry to study turbine fuel cleanliness. Its purpose: to assure Shell's ability to deliver absolutely clean fuel to your engine.

As a result, today's Shell turbine fuel is of outstanding quality. You can buy it with absolute confidence.

Whether plane you fly, wherever you fly it, Shell's experience in aircraft fuels and lubricants assures you of top performance.

5. Shell and fuels of the future. Shell has developed a special hydrocarbon fuel for Mach 3 flight. But the craft that will use it has yet to be perfected. When they are, Shell will be ready.

Shell rocket fuel—UMF[®] C—is in final proving the first stage booster of many of today's satellite vehicles.

Special note to airport dealers

Shell's offers independent dealers a complete range of services.

Shell's technical representatives are backed up with the solid experience and technical know-how that has made Shell the nation's top supplier of commercial aviation fuels.

Shell's advanced products and equipment with pilot aware that you will get probably deal with a Shell dealership.

Contact your Shell District Office for details or write: Shell Oil Company, 50 West 50th St., New York 20, N.Y.



A BULLETIN FROM SHELL
—where LAB scientists are helping to provide better products for industry



ENEMY LACK OF RECONNAISSANCE "PROTECTS" THE ALLIES AT GALLIPOLI

Gallipoli was a test for reconnaissance.

In 1915 the Allies struck at Gallipoli, intending to pierce the vital Dardanelles passage, capture Constantinople, remove Turkey as an effective fighting force and buoy the flagging spirits of their Russian ally. But the Gallipoli landings ran afoul of entrenched masses of determined Turkish troops. The stalemate continued from April through December, 1915. Finally, the Allied high command decided to evacuate—quite a trick with opposing trenches were often only one foot apart! If the Turkish ally should have an inkling of the evacuation before completion—if one effective reconnaissance flight were to guarantee the Allies' disappearance strength, it would mean disaster—perhaps the loss of some 80,000 Allied troops.

But, while Turkish pre-war planning carefully built a large army, the generals ignored the value of recon-

naissance, thereby allowing an entire army to escape intact. Allied Turkish and German sea forces, too, were taken off guard. For five days troops and supplies were directly taken off and only 1500 Allied soldiers remained the lines against the more Turkish army. And finally everyone had gone. Casualties? It was small.

The spirit and nerve instillation of the Turkish army had been weakened by lack of reconnaissance, a costly oversight.

From the beginning of command on the face of the earth, reconnaissance has helped shape history. Today GAT's specialty in this area is helping shape history to the advantage of the free West. Typical of GAT contributions are **V.I.P.** Visual Integrated Reconnaissance, data display system, **KA-30** the world's most versatile aerial camera, **SOLO** the only electro-optical "loadable new" pipeline system.

WHO'S WHERE

In the Front Office

W. C. Hobbs, a vice president North American Aviation, Inc., Los Angeles, Calif. Mr. Hobbs' nomination is directed to the senior vice president-administration. Also, **William E. Fisher**, vice president program management, North American Aviation's Space and Information Systems Division, Downey, Calif.

Carl K. Buggs, a vice president, Page Communications Engineers Inc., West Virginia, D. C., a subsidiary of Northrup Corp. Mr. Buggs is also company director of research and development.

James J. Lammie, vice president light aircraft division, American Airlines, Inc. **George F. Faby**, executive vice president and general works manager, Sparco, Inc., Milwaukee, Wis., and **Robert J. Rogers**, director of sales.

L. A. Nudiside, vice president engineering and sales, Rembrandt Corp. a Delco Products Division, Midvale, Mich. **George A. Strumpf**, a vice president and technical consultant, Thru Industries, Beverly Hills, Calif.

John W. Boone, a director, Aspen Electronics, Inc., Ft. Lauderdale, Fla. Mr. Boone is financial vice president and treasurer of Radiation Inc.

Richard K. Hoffman, vice president marketing and engineering, Tropic, Tulsa, Ok., Norman, Ok. **Frank P. Kelly**, secretary Mr. Hoffman is vice president manufacturing.

Dr. Charles J. Benhamer, executive vice president and general manager, Gubic Corp., San Diego, Calif.

J. M. Halden, vice president electronics, Devere Industries, Inc., Dallas, Texas.

Richard P. Allen, secretary, Raytheon Co., Lexington, Mass.

Col. George Robinson, Information Officer, Tactical Air Command, Langley AFB, Va.

Thomas E. Dunham, Jr., administrator of the Research and Technical Services Administration, Department of Commerce.

Harold E. Fells, vice president and director of engineering, Vibration Instruments, Inc., Tulsa, Ok.

William S. Fawell, president and chief executive officer, Bessel Products, Inc., Berkeley, Calif.

Honors and Elections

Vern E. Cebanese, elected president of Aerospace Instrument Corp. has received the Thomas E. Thiering Award for "his outstanding accomplishments in research, engineering, design development and manufacturing of air and air navigation equipment."

Northrup Corp.'s Northridge Division has received the "New Columns of Honor" for its role in the Polaris Fleet Ballistic Missile Program.

Donald G. McDowell, engineering vice president of both Electric Co. has been named recipient of the National Union Award of Merit for his part "National Union is preparing for improving Service Industries."

(Continued on page 108)

INDUSTRY OBSERVER

► Air Force has run 46 of its test pilots through the Drive-See selection program and has retired each in one of three categories—good, excellent or outstanding. Step 1 subvisual flight will be made with both F-4 and NASA test pilots. A contingent of pilots already has been assigned in B-70 to assure their participation have the earliest possible design phase.

► Proposals for a series of about six studies on water ramjet and related airfield vehicle problems have been requested by Air Force Aeronautical Systems Division. Studies will include space ramjet; launch and flight; and techniques for launch and other aerospace vehicles, and orbital attachment and grappling techniques.

► Navy will buy a tandem two-door version of the Chance Vought F4U fighter for test and evaluation. The aircraft probably will make its first flight next year.

► Navy has fired an Athena Research Area sounding rocket from a tube floating in the Pacific off Ft. Meigs as a part of Project Epsilon. Three more Athena launches are planned. Rockets are fired by electric cable strung from the tube.

► Results of Slonair studies on military gate-to-gate support systems are scheduled to be presented to USAF Aeronautical Systems Division next month. Planned Slonair studies are being conducted by Douglas, General Dynamics, Lockheed, Martin, Northrup and General Electric (AW ET 24, p. 21).

► Tests of high performance solid fuel rockets at Arnold Engineering Development Center show that solid aluminum rocket substrates produce a substantial impulse gain at sea level, these engines, such as the Maxtrons that stage, don't produce the same impulse gain in tests under high altitude conditions.

► Navy will expand its Naval Tactical Data System to add about 80 support capability to its planned integrated fleet defense weapon system.

► Air Force recently added two supplements to Aerojet's original \$4.2-million large segmented solid fuel booster development contract, including \$500,000 for firing additional stages, probably 1-3, depending on the results of tests for developing a thrust vector control system for the segmented engines.

► Proposals for NASA's Stratos-50 stage competition were scheduled to be submitted by Douglas Aircraft Company, General Dynamics-Aerostar and North American. The 50 ft stage, which is to be 50 ft in length, 27 ft in diameter and powered by four Rocketdyne J1 engines, will have to be built near Memphis under a lot of time to be brought to Cape Canaveral.

► Latest approach in streamlining the Westland Ronseley runs by jet aircraft use of a bullet shape mounted in the intake to diffuse air flow. Westland also is exploring design of a new rotor for the Mark 1, Roll-Rotor Type powered model. Each blade would house a number of small combustion chambers thus allowing the loading edge, spreading the jet effect and reducing noise.

► North American Aviation Australia's electronic fire-control computer will be delivered to Boeing in September. The system will be installed with a Boeing-developed autopilot capable for flight testing on the 707-30 prototype, which is now being used for 727 landing performance tests. Australia tests are to begin in December.

► Message communication package, to be launched into orbit by a Blue Scout vehicle to test the Mexico tracking and communication network has encountered problems and its original launch date has slipped several weeks.

► Mitsubishi Heavy Industries (Riesengeduld) is expected to receive an order soon to build a rocket launch aircraft from the Research and Development Office of the Japanese Self Defense Agency. The 17th liquid rocket powered aircraft is to be capable of short take-off and land. First flight is planned for 1965.



CHICAGO AERIAL INDUSTRIES, INC.

30 WEST NORTHWEST HIGHWAY, BARRINGTON HILLS • IRVING DAVENPORT LOS ANGELES WASHINGTON D.C.
OTHER DIVISIONS: KRYPTON, CHICAGO AERIAL SURVEY, FORTY-FIVE, DOWNS, PACIFIC OPTICAL CORP., Engineering Corp.

Do You Control Motion? Restrain, Release It? Silicone Fluids Are Helping Rewrite the Rules

Need a big-minded spring to fit a positive spacer? You can now get a fluid spring 1/160 the size of an equivalent coil spring. Need a hydraulic shock absorber with a flat-topped energy absorption curve between strains 60 and plus 500 deg. F? You can now get it. Want the time in one unit? You can get that, too.

The common denominator of such high-performance devices is a series of Union Carbide Silicone Fluids. They range in viscosity from 10 centistokes to 160,000, with peak points as low as minus 65 and flash points above 600 deg. F.

the highest Lucas has polymeric fluids—combined with stability at temperatures to 500°.

The gas seal compatibility of Union Carbide L-45 and L-507 lets use fluids compared to conventional mineral oil is shown in the accompanying chart. The viscosity-temperature coefficient ($\frac{1-V100^2}{V100^2}$) for L-45 with mineral viscosity at 100 cent. is 0.03.

NAME YOUR OWN SPRING RATE

Taylor Devices, Inc., of North Tonawanda, N. Y., is one of the companies adopting these high-viscosity liquids to hydraulic expansion in its tension and compression devices. Its example: using a stepped tubular piston design, and L-45 fluid, they achieve virtually any desired spring rate and force within a compact, structurally simple configuration.

Again, in spring shock absorbers where high mechanical energy is converted to heat energy, Taylor Devices find Union Carbide Silicone Fluids greatly extend the useful work range of the units.

Among the jobs such devices are per-

forming are: Servo-valve cushions to restrict motion, taking impact loads on air-actuated control lines, reducing control valve leakage. In addition, they arrest shock absorber mechanisms at impact, stop shock of paper on paper action, and control feed rate of electrodes in electron beams.

R AND D TO HELP YOU

If you design hydraulic equipment for tough duty, you know Union Carbide Silicone Fluids has a wealth of technical know-how on the ways Silicone Fluids can help you obtain outstanding performance. Behind him are the vast experience and research of Union Carbide Corporation's virtually every type of industry.

We invite you to send us your comprehensive "Design File" on Union Carbide Silicone Fluids for Mechanical Applications. It gives you a one-hour package just about all you need to know about silicone fluids for your design requirements. Mail the coupon today.



Union Carbide is a registered trademark of Union Carbide Corporation.

Shipment Details:
Union Carbide Corporation
Dept. CA, 1000 28th Avenue
Spartanburg, S. C. 29576
In Canada: Union Carbide Canada Limited,
Burlington, Ontario, Canada

Please send me your "Design File" on Union Carbide Silicone Fluids for Mechanical Applications.

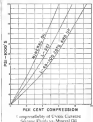
Name _____
Title _____
Company _____
Address _____
City _____ State _____



MAKING FINEST CAPACITY. This combination, say, about 1,000,000 psi. Taylor liquid spring utilizing the primary liquid properties of Union Carbide Silicone Fluids is said to be the highest force spring ever produced in a single unit. Only a few in America, it could support three of the largest locomotives. The top of it is Taylor's metal liquid spring. Inside it is a miniature and liquid of about the big spring's size, but providing a very strong force.

COMPRESSIBILITY PLUS STABILITY

Two of silicone fluid's outstanding properties contribute greatly to their growing usefulness in a variety of hydraulic devices including springs, shock absorbers, torque converters, disk pads, valve lifts, many more. These are compressibility—



Compressibility of Union Carbide Silicone Fluids for Mechanical Applications

U.S.-Soviet Bilateral

Washington Roundup

Negotiations between the U. S. and Soviet Russia on a bilateral air transport agreement are expected to reach an early climax—possibly within a week. Chances of reaching some accord on a reciprocal New York-Moscow route appear to be about 50-50.

As early as last February, the U. S. stated its position that standards set by the International Civil Aviation Organization and the International Air Transport Association must also be guidelines in finalizing an agreement. Russia's counterproposal as these talks moved forward in the U. S. said the opening day of negotiations. Discussions began as soon as the Russian proposals were translated, but the U. S. has not with unqualified approval.

Commerce Department has recommended to the White House that measures be taken to expand the use of air travel by airlines, the possibilities of reducing air fares to promote new markets. It also has urged that the standards of the Federal Aviation Act be studied to see how many breakdowns in airline laws management of airlines can be corrected. Commerce told the White House it is concerned over strikes, airline traffic, and work stoppages which it has been "frankly" concerned over recently.

Patented Approach

National Aeronautics and Space Council is trying to work out a government policy on patents for inventions developed under the communications satellite program (see p. 25). Edward C. Wright, the communications secretary, has just begun the study and he plans to use the same technique that resulted in numerous agreements among federal agencies allied to the recent presidential policy announcements on the lunar landing program and the communications satellite.

Wright will call everyone involved into the same room at the beginning and keep calling them back until agreement is reached. He will meet soon with representatives of the science and technology community, National Aeronautics and Space Administration, Commerce, and Justice Departments.

New congressional study to determine who should do what in the U. S. effort to land men on the moon is about to get under way as the House space committee. First step is a staff review looking out the most productive areas of inquiry for space crew member numbers. The objective is to take a broad look at the nation's capabilities with emphasis on how the lunar program can best be managed. This would be the first full-fledged congressional study of the program since President Kennedy presented his lunar plan late last May.

'Spy' Satellites

Since Sputnik 1 was launched almost four years ago, there has been no settlement of two key issues: spy satellites—how high, and whether earth stations must be space-based and whether earth stations must be space-based.

Soviet Russia's satellite publication Kommunist Zvezda has repeated the argument by stating that USSR's Molnia III and the civilian Tselina III both launched July 17 and both carrying Soviet troops, are spy satellites similar to the Lockheed U-2 aircraft, adding: "A spy is a spy no matter at what height he flies." The flight of the satellites, says the foreign writers, are acts of aggression. "Soviet Russia does not admit that it is a satellite for any kind of surveillance; it gives at least a propaganda advantage in leaving its position to decide with the masses."

Italy's launching of a solid-fuel rocket under and subsequent launch concerns relating to "defense" problems continue to have repercussions. Following a discussion about the war in which the last was recalled to the public, the Italian cabinet decided on foreign acts of political and international aggression, should be eliminated for good approval to a constitutional amendment, which apparently will be approved at the next cabinet session.

The United Arab Republic and Israel's plan "Two a right to change the name of the Israeli state 'Mooravia' and to give it the Hebrew name 'Shalom II' but and Israel" interrupted the "house" when it criticized the UAR for trying to buy rockets from U. S. firms.

Mercury Reactions

Most of the legends that shrouded the Astronaut Virgil G. Grissom after his Mercury flight last year 50 required some explanation or potential threats for his safe return. But one remained: "the group of 50" (Mercury) launched in New York and caught "Atlantic" 100. For German comment radio broadcasters took a different view, calling the flight another of "the worst mistakes" U. S. rocket tests in which human lives are risked recklessly for the sake of a prize, gain of prestige.

Because the three-man National Aeronautics and Space Administration-Defense Department Executive Committee for Joint Lunar Study (see p. 25) has no chairman and each man has an equal vote, the group is known around Cape Canaveral as "the triad."

—Washington Staff

Kennedy Asks More Aircraft, Missile Funds

\$1.3 billion requested for Fiscal 1962 procurement; total defense budget is increased to \$47.5 billion.

By George C. Wilson

Washington—President Kennedy is asking from Congress—and will undoubtedly get—an extra \$1.3 billion this fiscal year for more manned aircraft and missiles as part of the U. S. budget to meet a Berlin crisis.

The Administration wants to spend \$361 million to keep older aircraft in service and to activate reserve air units, while \$157.5 million is planned for buying new aircraft. Although the President did not ask for more money to buy bombers, Congress is expected to appropriate it anyway.

In essence, the President wants \$177.5 million for procurement and an additional \$14 million to replace the T-28 and T-28B in Navy depots.

The \$1.3 billion for aircraft and missiles was part of the total \$1.45 billion additional the President requested to help strengthen the non-nuclear part of the armed forces.

The new request increases the total Fiscal 1962 defense budget request to \$47,500,113,000.

President Kennedy told the nation last week that the extra defense money is needed "to make clear our determination and ability to defend our rights at all costs and to meet all levels of urgent pressures with whatever levels of force are required."

Fair Congressional Action

Secretary of Defense Robert S. McNamara and other Pentagon officials outlined the money requests before a closed session of the Senate Appropriations Committee. Defense Department Solicitor General Acting Chairman A. William Robertson (D-Va.) plans to read his defense bill with the addresses for three action this week.

The House also is moving quickly to give the President the money he requested.

In addition to asking for more procurement and operation and maintenance funds for Fiscal 1962, President Kennedy asked Congress for more money and authority to increase the size of the Air Force, Army and Navy. He requested \$751 million additional for military personnel to be divided among the services this way: Air Force, \$154 million; Army, \$492 million; Navy, \$50 million.

This would finance three increases in manpower: Air Force, 55,325; Army, 131,000; Navy, 29,300.

President Kennedy also submitted draft legislation to Congress to expedite laws to activate up to 250,000 men into the fiscal year and requested Congress to authorize the secretary of defense to extend enlistments up to 12 months. Further, he said draft calls would be

doubled and tripled in the coming months.

No new money was requested for research and development. But the Senate appropriations subcommittee is expected to provide additional millions for stepped up development of the B-70. The McNamara budget contains \$254 million for the B-70, but Air Force Chief of Staff Gen. Curtis E. LeMay recommended that the Senate appropriations subcommittee provide \$448 million (AW July 24, p. 22).

Budget Increase

The biggest single increase among the new requests was for procurement—\$175 million—with the Army slated to get \$557 million for equipment and missiles and the Navy \$443.6 million for aircraft and missiles. The Air Force

is to get \$220.5 million of the procurement funds for aircraft and missiles.

Here is a breakdown of the new funds requested by President Kennedy for aircraft and missiles as well as some of the justifications given by McNamara in a statement released by the White House appropriations subcommittee.

•**Air Force**—Requested \$241 million for new aircraft on the Republic 1-109D supersonic "all-weather" fighter bomber and the Lockheed C-119D and C-119B jets. Although McNamara specifically mentioned those airplanes as being on the procurement list, he did not rule out buying others. He said the Defense Department also plans to buy additional Boeing and long lead-time counterparts for the C-119B, so that the planned peak production rate could be maintained. "An additional \$62 million is sought for missiles, including a large number of Sidewinder and Bullpup for tactical fighters and Talons for troop missiles for interception."

•**Army**—Requested \$367 million for aircraft including Bell Incoques and Hawk helicopters and Beech Scoutmaster attack aircraft. The Defense Department asked \$19.2 million to provide more Hawk fuel and two medium helicopters for them. In addition \$144.5 million is sought for new aircraft. Nike Hercules missiles and Hawk missiles for tactical air defense.

•**Navy**—Requested \$281 million for

additional aircraft, including Douglas A-1J2N attack, replacement Chance-Vought F9F-7N and McDonnell F4H-1 fighter, plus patrol, search and transport aircraft and helicopters. The Navy Department also seeks \$381 million for tactical and air defense missiles—including Sidewinder, Sparrow, Tartar, Terrier and Talos.

The Kennedy Administration requested \$745 million more for military operations and maintenance with a similar size to be used to keep both Strategic Air Command bombers on a 15-month ground alert. The Administration also asked for \$24 million to ensure that all the Boeing B-57 and B-57 bombers are kept in the type of alert and 545 million to replace B-57 wings and other broken wings slated to be phased out of service this fiscal year.

The two actions, McNamara said, "will provide a significant increase" in the number of B-57s on 15-month ground alert at the end of Fiscal 1962.

In a letter to SACSC, President Kennedy requested \$17 million additional for personnel to provide more ground control of interceptive aircraft at military bases.

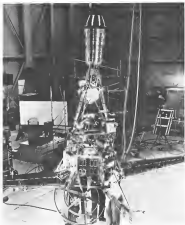
"If we are to have the capability to react their additional combat forces [requested in the President's] program to wherever they can be needed we must successfully create our size and air lift. The President requested money to modify troop transports, amphibious ships and to activate "manned squadrons" of C-119s slated to be phased out of service in 1962.

He said "we would also be prepared to order to active duty, Reserve" squadrons from the Air National Guard and C-119 squadrons from the Air Force Reserve." He said retaining the C-119s and activating the reserves requested the President's new request for \$72 million.

Carrier Reactivated

The Navy plans to activate another aircraft carrier as well as several fleet support ships. The increased activity will necessarily spending \$18 million more than contemplated for reactivating Navy airplanes and \$18 million more for activating such shipyarded defense ships as the T-28 and T-28B.

To provide the tactical air support for the increased ground forces McNamara said the Air Force would re-activate some of its light bomber, assault and tactical fighter squadrons scheduled to be phased out of service. This would cost \$14 million. In and The Administration requested an additional \$174 million to the Air Force "and \$4 million" activate Air National Guard squadrons and tactical aircraft ground groups. An extra \$3 million



Ranger Prepared for Lunar Exploration

Ranger spacecraft's development of late includes in the area which willoughland maneuvered payload on the moon will be launched into orbit by an Atlas-Agena B Gold plate white paint and painted aluminum is used in the Jet Propulsion Laboratory Ranger 1 to create its polished appearance in the space environment (AW July 24, p. 39).

was used to maintain the tactical air control system in Europe.

President Kennedy requested an extra \$207.6 million for the Defense Department's end defense program. McNamara said it is a "series of decisions" of which he might be called but a comprehensive modern program can provide a great deal of protection for people who are not close to assets of defense." He said the program objective is to supply enough light aircraft "to provide reasonable adequate protection for assets consequent of the population."

Of the \$207.6 million sought, \$91 million would go for building systems in existing buildings, \$18 million for building existing buildings, \$7.5 million for new shelters in new federal buildings, \$55.5 million for annual supplies, \$15.5 million for new, hardened storage system and improvement of existing

systems. \$9.3 million for radiological detection equipment, and \$13.3 million for research and development.

Along with these specific actions, in quarters, President Kennedy asked Congress to add a section in the Defense Department appropriations bill on increasing the security of defense to transfer up to 1% of the money in our budget account to another. This is from McNamara and "would provide much needed flexibility." He said the appropriations would be subject to the approval of the congressional appropriations committees. The Administration also asked Congress to delete the provision in the House passed appropriations bill limiting the number of officers who can receive flight pay. McNamara said it is "impossible for us at this time" to estimate the number of officers who will be eligible to receive flight pay.



Russian Film Shows Vostok-Labeled Capsule

Capsule identified by labeling as the Soviet Vostok says they is photographed in a Russian documentary film "First Trip to the Stars," actually shown in Moscow on the day of the Vostok's ascent. This configuration is somewhat like the one carried by helicopter at the show (AW July 17, p. 10) but lacks the antenna housing at the stem. All sections of the capsule in order to use the Russian-McNamara capsule (AW July 17, p. 11) and is having a white-tinted oval emblem (oval behind the white-tinted emblem) in the same relative position.

New Budgeting Plan Shifts Rivalry From Services to Weapon Systems

By Katherine Johnson

Washington—Congressmen for defense dollars will shift from services to weapons to weapons to weapons under Defense Department's new program for functional budgeting, according to Assistant Secretary of Defense George Charles H. Hitch.

Telephone talk took place before the Senate Subcommittee on National Policy Mechanisms, Hitch and that committee's ranking member, Senator Charles McNell, said that the new plan will be a "substitute" for the dollar ceilings imposed on the services in the past.

The new budgeting system is being interpreted as a first major step toward a reorganization of military forces along functional rather than man-in-arm-and-artillery lines.

In his testimony, Hitch noted that Gen. Taylor has long urged a functional budgeting system. Under a reorganizing plan, he said that the new budgeting plan "may be as different as the night" from the present way of the forces, but does not necessarily involve them.

W. J. McNell, Hitch's predecessor as Defense secretary, followed him as a witness last week, before the sub-

committee McNell said that the military reorganization would automatically follow from the new budget system because "management or command structure follows the money." He opposed the new plan on the grounds that it would inherently divide—and separate—forces according to weapons systems.

McNell commented that, for example, "in the formulation of national policy there are those who think the allocation by arms is considered not as important as comparison to weapons systems."

Damning the hearing, Sen. Henry M. Jackson (D-Wash.), chairman of the subcommittee, noted that in the past the Navy has been reluctant to allocate funds for the Polaris program because it would appear to reflect a Navy program. Under the new package budgeting system, Hitch noted, Polaris would be subject to competition with other strategic forces, rather than other Navy programs.

Long-range funding of possible for the entire life span of a weapon system from research through obsolescence will be used to achieve self-reliance, with cost weighed against uniform effectiveness. Operating cost as well as development and procurement cost will be considered.

As an example of the importance of operating cost, Hitch pointed out that the bomber spending one of a \$1.2

million approximately the procurement cost of \$500 million.

Part Defense budgeting on a value-at-risk basis, Hitch told the subcommittee, "did not indicate the relative of costs to weapons systems, tanks, and missiles. In true business we now limited. It did not disclose the full time placed costs of proposed programs. It did not provide the data needed to make accurate cost effectiveness of alternative programs."

The new budget will be divided into seven major categories, called "program packages." Central War, Offensive Forces, General Forces, Defense Forces, Self-Defense, Research and Development, Support, and Services and Support.

Defense, together to complete a program for the next five years in September. In October and November, the Fiscal 1967 budget implementing the first phase will be prepared.

The timetable established for each of the seven major categories of the new budgeting system will be included in each "program package" on Aug. 26. The elements are to be funded for a minimum five years, and, if possible, through 1975. No dollar ceiling will be set.

At Force and Navy already have met this July 5 deadline for submissions to the new offensive package, recommending 1968 ballistic missiles ready for firing from the continental U.S. and submarines by 1970. The next deadline is Aug. 21, for submissions to the central war defense package.

Hitch pointed out that Defense will continue to have budget goals for the first phase, such as "personnel," "research and development," and "support" for each of the three services. Two budgets, showing the defense dollar in two different ways, will be submitted next to Congress, he said.

In addition to submitting costs by appropriation, obligation, and expenditure for the first phase budget, the services will be required to submit three new categories of costs for each program element:

- Research and development, including all facilities, supply, and personnel costs applicable to a weapon system
- Operating costs, a more advanced plan, which emphasized, a total program budget in the future can be drawn "afterwards" because there should be no need for a budget and full "program" review concerned into a few weeks.
- Investment costs, including all costs to bring a weapon from the development phase to the operational phase—testing, launch, maintenance, hardware.

Kennedy Sets Commercial Satellite Policy

Washington—President Kennedy set down the general rules last week for U.S. operation of a communications satellite system, and directed the National Aeronautics and Space Administration to submit the overall policy by agreeing to launch two experimental satellites for the American Telephone and Telegraph Co.

Three top-level policy decisions were announced by Federal Communications Commission action directing a committee of international carriers to recommend what should be and operate the communications satellite system. The ad hoc carrier committee, composed of 10 international carriers, is to meet Aug. 1 and submit its report by Oct. 15.

At the same time, FCC demanded petitions for General Electric Co. and General Telephone and Electronics Corp. to broaden the membership of the communications satellite system beyond international carriers. The FCC order did not rule out broadening membership, however, where policy discussion was further along.

President Kennedy's policy statements on communications satellites are the first ever issued publicly. In any field of state and war developed to grade defense regulations and decisions by all U.S. government agencies—particularly the FCC, Justice Department, NASA and State Department.

Public Interest

"The primary guideline for the preparation of such recommendations," President Kennedy said, "was that public interest objectives be given the highest priority. I agree with all nations to participate in a communications satellite system in the interest of world peace and brotherhood among peoples throughout the world."

He added that the question of who will operate the communications satellite system has not been decided, stressing that "no arrangement between the government and private interests can be approved unless it is to the public interest."

The President said "private ownership and operation of the U.S. portion of the system is broad" provided the carrier and operation meet his policy requirements. The policy statements were evolved during discussions which began June 15 meeting the members of the National Aeronautics and Space Council.

President Kennedy, and Executive Secretary Edward P. Tamm, discussed the effect which produced the policy report.

White told Aviation Week the ob-

jective was to provide general rules "reasonable" that everyone could live within them and no future President, after the system, would be forced to renege them. He said initial action in the policy statements was "very favorable."

The right policy statements regarding ownership and operation of a communications satellite system stipulate that (1) "New and expanded non-national communications services" are to be made available "at the lowest possible rates"; (2) the system is to be "based on a cooperative, voluntary system where individual portions of the coverage are not profitable"; (3) opportunities for foreign participation are to be provided through ownership or otherwise; (4) "non-commercial use of and equitable access to the system by present and future authorized communications carriers" is to be assured; (5) there is to be "effective competition, such as competitive bidding, in the acquisition of capacity rights"; (6) ownership or control should assure "maximum possible competition"; (7) there is to be "full compliance" with anti-trust laws and regulation controls; (8) an "essential system" is to be developed, "the benefits of which will be shared in various communications systems."

White and the eighth policy statement stress that profits from the satellite system should be used to reduce rates on other communications channels.

These were the eight policy statements on U.S. government intervention in U.S. communications satellite system, in addition to its acquisition, use, and operation, and "maximum" research to advance the system, (2) support international agreements and negotiations; (3) control all handling of U.S. satellite; (4) "the United States will not support any system if the commercial use of it will not fulfill 'maximum government needs'"; (5) assure the effective use of the radio-frequency spectrum; (6) be able to "control" the system; (7) help "develop" developing countries; (8) into the global communications system.

The President said "private ownership and operation of the U.S. portion of the system is broad" provided the carrier and operation meet his policy requirements. The policy statements were evolved during discussions which began June 15 meeting the members of the National Aeronautics and Space Council.

President Kennedy, and Executive Secretary Edward P. Tamm, discussed the effect which produced the policy report.

White told Aviation Week the ob-

jective was to provide general rules "reasonable" that everyone could live within them and no future President, after the system, would be forced to renege them. He said initial action in the policy statements was "very favorable."

NASA Administrator James E. Webb told the House Subcommittee on Foreign Commerce Committee last week that he interprets the President's policy statements to mean that NASA should "provide leadership and direction for the extensive research and development effort" needed to establish the communications satellite system "at the earliest possible date." In this connection, Webb and NASA will provide AT&T with "the facilities for handling a total of 100 to 200 such communications channels in the near future."

Chairman Norton M. Mowbray of the FCC told the same House committee that "no future action" the FCC takes "will of course be guided by the national objective as set forth in the President's statement of policy." He added that those objectives also will help guide discussions of the committee of international carriers at their meeting Aug. 1. Mowbray said the proposals coming out of that meeting "will have the same" for the discussion on the ownership and operation of the communications satellite system.

Ad Hoc Committee

Members of the ad hoc inter-agency committee, American Cable and Radio Corp., AT&T, American Telephone Co., Press-Warner, Inc., Radio Corp. of Puerto Rico, RCA Communications, Inc., South Eastern Bell System, Continental Cable Telegraph Co., U.S. General Radio, General Western Union Telegraph Co. The FCC naming various other carriers to the meeting directs them in their report to state how much capital each carrier could contribute to the on-ownership system.

The naming of the various carriers figured in the FCC's draft of General Electric and General Telephone and Electronics Corp. petitions regarding the ownership of the communications satellite system. The FCC membership in the system open to all, while General Telephone asked the FCC to include domestic carriers as well as foreign carriers. General Telephone also requested the FCC to include domestic carriers as well as foreign carriers. The FCC's decision followed the FCC's First Report of May 24 which concluded that a system owned by international carriers appeared to be most practical.

The FCC order and the two companies' recommendations, the first report of the First Report is to be included. The FCC and the First Report did not set forth final policy but was instead a preliminary report and subject to change.

FAI Certifies Astronaut Shots

Free-Flighters Astronauts International announced that its space committee had completed an analysis of Soviet S-1 and U.S. space shots and the following results are now official.

On Aug. 12, 1961, Soviet Astronaut Yuri Gagarin orbited three times FAI space records: length of orbital flight, 105 min.; highest altitude reached on orbital flight, 127 km.; largest volume lifted during orbital flight, 4,725 lb.

On May 5, 1961, U.S. Astronaut Alan B. Shepard Jr. established three new FAI space records: altitude reached without orbital flight, 168 ft.; largest volume lifted without orbital flight, 1,100 lb.

An FAI announcement noted that these five space records were the first of their type and indicated that a new series for FAI. The records were approved by FAI's 19th member space committee established in October 1960. This committee, headed by Dr. D. L. Lanza, General Electric, approved the new records at a special meeting last July.

Committee also is making FAI believe in an attempt to establish three FAI records on orbital flights. Three Soviet records of FAI's space committee, for example, appear in principle that as FAI charter should be on hand for future FAI space shots. However, Lanza, pointed out that FAI had no definite answer that the Soviet Union would carry out this agreement.

James Allen, FAI president and member of FAI's space committee, was on hand for the Shepard shot.

FAI space committee, in addition to Dr. Lanza as chairman, has R. B. Dillmore, of the U.S. in vice chairman and Col. Gerts, of France, as committee secretary.



LOCKHEED's helicopter is designed to test rigid rotor concept. Flight tests are being made 55 mi. north of Los Angeles

First Photos Show Lockheed's Helicopter

By William S. Reed

Los Angeles—First photos of Lockheed Aircraft Corp.'s first testbed helicopter in flight in Rye Canyon near Ontario Junction 55 mi. north of here provide first design details of the program-funded project.

Concerning the helicopter, Lockheed said that it is "the first to succeed in using the inherently stable gyro effect of the rotor blades to maintain control." The helicopter is inherently stable, Lockheed claims, and has resulting ease of handling together with mechanical simplicity.

Design Principle

Design principle used is a rigid rotor which accounts for claims of reduced manufacturing costs and lower maintenance.

The blades are non-articulated eliminating the familiar "clapping" noise produced by most helicopters in flight. The noise was absent during the flights observed by Aviation Week.

The Lockheed helicopter appears to be about 35 ft. in length and is mounted with a tail strip running lengthwise along the fuselage. Its three-bladed rotor has a diameter of about 50 ft. A two-bladed antitorque rotor of 5.5 ft. diameter is protected from ground contact by the deep oil fuselage structure. Power is supplied by an engine in which

appears to be the 105- to 350-hp class. Two pilots are carried in side-by-side seats with visibility provided by a wind shield over a solid nose. A tricycle landing gear supports the helicopter on the ground.

Most unusual feature of the aircraft is a large ring about 4.5 ft. in diameter positioned just above the fuselage and below the nose. This ring rotates with the rotor and has three arms extending to each of the blades. The presence of the ring appears to be an important component for the gyroscopic principle in development of the rigid rotor concept.

In operation, the Lockheed helicopter seemed to be capable of rapid lateral flight and smooth transition to slow flight. It was brought to a hover with little of the shake and shudder exhibited by most other rotary-winged vehicles. No large addition of power was found as the machine went to hovering flight as it is the case with conventionally controlled helicopters.

Flying Testbed

Lockheed pointed out that the helicopter is not a production or prototype aircraft. It is a flying testbed which has neither a production configuration nor perceptible. The engine used was selected for horsepower and reliability and is not necessarily the one best suited for the machine. Principle of the

control system is adaptable to both piston and turbine powerplants and can be used on both small and large helicopters with equally satisfactory results.

Vice Adm. John T. Hayward, deputy chief of naval operations-development, recently visited before a subcommittee of the House appropriations committee that the Lockheed helicopter is a tremendous advance.

It looks to me like this is the last real step forward in the helicopter business toward bringing about a cut in cost, maintenance, to improve reliability and to make it easy to train pilots." He further said it is the answer to what is new in the helicopter field.

LOH Entry

Lockheed entered the helicopter in the recent light observation helicopter competition but did not win (AW May 29, p. 27). At the time of Adm. Hayward's testimony, some consideration was being given to a joint Army-Navy project to further develop the helicopter concept in the event Lockheed did not win the LOH competition.

An operational utility aircraft could be developed by January, 1964, if such a program were funded. However, Lockheed has not been awarded such a contract and development still is being company-funded.



TAIL ROTOR is protected from ground contact by deep oil fuselage structure. Helicopter has two side-by-side seats



ENDS between rotor and fuselage top has three arms extending to each of the rotor blades and rotates with rotor



Cape Canaveral to Expand for Lunar Task

By George Alexander

Cape Canaveral—Urgency with which the U.S. is pushing the national lunar landing program is being reflected here in the planned increase in storage, the expansion of facilities and the establishment of a joint National Aeronautics and Space Administration-Defense Department office, all in direct support of the project.

First step, now under way, is the acquisition of the upper part of Merritt Island, north of the large canal which runs across the island two miles. Second step still in planning is the extension of the Cape's present northern boundary 2 1/2 miles north of Joe's Bay Beach.

Third step, also in planning, will be to have a land fill effect on the island side in the actual role of the Cape. The Air Force's Coastal Missile Division support contracts for the Atlantic Missile Range, is recommending that the southern end of the Cape be extended 1 1/2 miles out into the Atlantic.

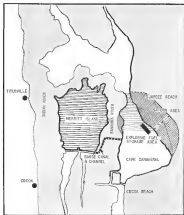
NASA and Defense Department has also established a three man Executive Committee for Joint Lunar Study, composed of one NASA representative, one USAF officer and one USAF official who is assigned to NASA, and a two man (one NASA, one USAF) Joint Lunar Study Program Office in the Air Force Missile Test Center headquarters building at Patrick AFB, just north of the Cape. Operating under what amounts to a priority, the committee and program office for the past several hours have been considering joint, unified testing groups of operational tests of NASA and Defense organizations for periods of several days to weeks to study and define various support requirements.

All reports from the groups are compiled in the program office and forwarded through the committee to NASA headquarters in Washington, D.C. Work reports provided to DOD.

Acquisition of the northern part of Merritt Island will provide further extended development of the land, now relatively unpopulated and considerably less expensive than nearby Cocoa Beach. There are about 100 houses on the island, with the bulk of the land given over to orange groves.

The step of beach north of the Cape, which the government is now considering and will probably buy, comprises Sunrise, Sunrise and Joe's Bay beaches and includes about the same number of houses as Merritt Island, with one subdivision of 10 lots in two rows.

Addition of that land to the Cape expansion will considerably alleviate the safety problems at the Atlantic Missile Range. Biggest potential difficulty



NORTHERN PART of Merritt Island and a five-step of beach north of the present Cape Canaveral boundary (dashed line) will be added to the island to support the national lunar landing program. Two land fill plans (dashed lines) are now being considered to provide additional launch area.

associated with the launch of a large booster such as Saturn is not the blast effects of a possible failure, but the very high noise levels which can damage both humans and launch.

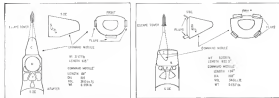
NASA's Marshall Space Flight Center, Huntsville, Ala., has determined that 115 db is about the maximum level to which humans should be exposed. For a person with margin, NASA has decided to use 120-125 db as a working figure. Based on static test data of the S1 first stage engine, NASA expects Saturn to generate about 160 db at liftoff in the launch area 115 db 0.5 mi distant and 105 db around a circle with a 6 mi radius.

Other uses will be found for the land, located some 10-15 miles from the Cape. The site of major communications stations, perhaps a liquid hydrogen plant and other support buildings. The beach strip will undoubtedly be the

site of other additional Saturn launch complexes in future contract contracts.

Various land fill schemes for the northern half of the triangle-shaped Cape have been discussed for years. Recently, however, two plans appear to be receiving more than passing interest. The first proposed would fill an area 0.5 mi wide and 2 or 4 mi long on the back of Merritt Island, side of the Cape, extending a few thousand feet below the present northern boundary, and extending to a point inland from Sunrise Beach.

The other plan calls for filling a strip 3 mi wide out into the Atlantic on the northern shore of the Cape's coastline. The latter seems more probable, in view of the substantial production schedule set for Saturn. It, however, entails risks, notably requiring a large number of launch facilities, spread over a wide area so as to minimize the damage by the explosion of any one vehicle.



AVIATION WEEK ARTISTS' concept of preliminary designs for NASA's Apollo spacecraft shows Martin Co. vehicle (left) and Ames Research Center vehicle (right). Both use tube or bay as entry capsule for deceleration and emergency egress.

Apollo Designs Use Nose Cone Concepts

Washington—All four preliminary design concepts for the three-man Apollo spacecraft use less or more blunt before making nose cone technology, but two introduce enough aerodynamic control so that the reentry capsule could remain in land instead of making a water landing as the Mars reentry does.

Designs produced by General Electric, Goodyear and Martin under National Aeronautics and Space Administration contracts, and a fourth produced by NASA's Ames Research Center, were presented to 1,040 industry representatives and about 100 representatives of other government agencies at a NASA briefing here July 15-20.

NASA plans to issue requests for proposals for development of the Apollo within two weeks after Congress appropriates the \$160 million requested for Fiscal 1967. Specifications which allow considerable more latitude than those issued for Mercury, in 1959 (probably will be issued late September and NASA hopes to award a contract by Dec. 31.

The three-man briefing dealt chiefly with the earth orbit mission planned for Apollo 4 and the emergency mission planned for Apollo 11. Observers at NASA and its three study contractors apparently have given relatively little study to the lunar landing mission planned for Apollo 11—agreement which was added to the program last May, by President Kennedy.

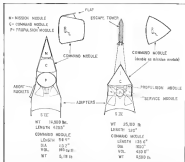
All four preliminary designs exceeded the planned 15,000 lb. weight by an average amount from 1,900 lb. to 5,100 lb. Nose (included) the entry capsules remain that will be needed for the return trip from the mission in Apollo 11. NASA put heavy emphasis on crew safety, apparently, the brief issues it is derived from the Mercury program. It hopes to provide a "shelter" en-

vironment for the crew, which will consist of a pressure-resistant, a navigational unit and an emergency egress. Capabilities for crew control of vehicle at all times will be provided if possible.

Liquid hydrogen and liquid oxygen apparently will be the propellants for the main propulsion system which will be used for entry and exit from lunar orbit, for emergency egress and for super-orbital short. This combination is superior to storable in weight and is favored over the other potential pro-

pellants considered—high energy solid, storable hydrogen storable and liquid hydrogen with a storable oxidizer. Although noted these choices also were favored by NASA.

Consensus of the studies is that ablating material surfaces will suffice for heat protection and that shockproof must be added to afford the significant probability that radiation from solar flares will be encountered. Van Allen belt radiation is not considered the primary concern, however, but together



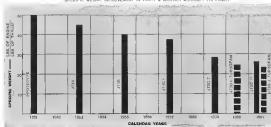
GENERAL ELECTRIC'S Apollo design (left) uses super-orbital reentry. Based that its short stay light in beach plane; other that uses lunar orbit reentry in other designs. Goodyear concept (right) has a common command module module.

JT3D pares down specific weight

Each new generation of Pratt & Whitney Aircraft jet engines has shown a substantial reduction in specific weight. (See chart below.) By far the most dramatic improvement, however, has been achieved in the specific weight of the JT3D-3 turbofan—22 to 26 per cent less than advanced conventional jets. In addition, the turbofan uses approximately 15 per cent less fuel at comparable cruise thrust. These improvements make possible lower operating costs, increased payloads, and more than 20 per cent greater range. **PRATT & WHITNEY AIRCRAFT**

(Division of UNITED AIRCRAFT CORPORATION
East Hartford, Connecticut)

SPECIFIC WEIGHT IMPROVEMENT IN PRATT & WHITNEY AIRCRAFT JET FAMILY



Large Solid Booster Program Under Way

Large solid-propellant booster program is being accelerated to meet the needs of National Aeronautics and Space Administration and Air Force Systems Command space programs by an inter-agency committee constituted two weeks ago.

The committee, membership includes Department of Defense, NASA, Air Force and Aerospace Corp. personnel and will prepare details of policy management structure and requirements within a 90-day period. The committee is simultaneously preparing detailed specifications and making requests for proposals.

The program generally will be tailored to meet NASA requirements but Air Force will manage the program with NASA coordination, through the development phase and preliminary flight readiness testing.

Requests for proposals for the large solid-propellant booster may be issued late in August or early September, depending on coordination of government agency plans concerning stage diameter and weights on which these appear to be a divergence of opinion. The expected-rocket configuration almost is certain to be formed.

Proposal submission likely will be required within two weeks after requirements issued, but this should not prohibit drop for the solid-rocket industry, but rather leave the general requirements of the program less than been anticipated for some time now, except for more solid-rocket industry is ready for the competition.

Letter Contracts

Letter contracts will be awarded in early to mid-1962 after proposal submission. This means that if a tight schedule is maintained, contractor is certain to be in position Oct. 1.

Management of the program will be put on a standardized basis. Air Force effort will be directed by Col. Langdon Ayres, Ballistic Systems Division, into plans working with Space Systems Division for the specific task.

Delays in review of program management progress will be minimized through the medium of detailed reports supplied at regular frequent intervals to Lt. Gen. Blamont M. Felt, Air Force Systems Command's deputy commander for the aerospace system, to Gen. Bernard A. Schriever, commander, Air Force Systems Command. This procedure will permit major management decisions in Col. Ayres, after review in Gen. Felt, to be presented directly to the Secretary of the Air Force.

NASA requirements for the large solid-propellant booster will be directed

to its Nova program (AW June 29 p. 31), while Air Force requirements are grouped through its Phoenix program (AW May 17, p. 30) indicating that a single unit will not be optimum for both because Nova is prepared to use large diameter boost rockets.

Air Force's requirement for Phoenix probably would be a solid motor of approximately 100-in. diameter, or about 5 ft ft.

Previous studies conducted for NASA indicate that solid rocket motors in the 140-in. to 170-in. diameter category, but probably, is that even a 360-in. diameter motor (11 ft ft.) which can be the specific unit motor (moderation might be too large for rail transport).

The NASA series will be the one to receive priority development, unless Air Force can generate funds for simultaneous development of its 100-in. diameter motor.

Motor Diameter

Indicates elsewhere in the solid propellant field that 17.5 ft diameter is a reasonable compromise size for launch, because allowing one-half foot for the stacking handling gap would bring the

diameter to 15 ft which could be accommodated by standard launchers. A solid motor 15 ft ft. in diameter would introduce considerable difficulties in a lift requiring special rail cars and loading, thereby incurring additional expense.

Differences in performance in the two cases of solid motor could cause no serious problems, the discrepancy being accommodated by adopting a longer length for the smaller diameter rocket. Web thickness would not be affected, since the parameter only would be affected by the slant (flow) characteristics of the specific propellant.

Contractor Selection

In development of the large NASA motor, probably, is that a contractor would be selected for parallel development, supplemented in simultaneous development of final injection thrust (solid rocket motor).

At one time in the program, if Air Force several contractors to proceed with its 100-in. diameter motor, a new, third contractor would be selected.

Full-diameter, single-segment unit will be involved in initial tests in such contract. First test in the single

Gulf Site Considered for Nova

Ground was without launch facility for firing solid-propellant boost rockets in a contract program for a "giant" solid rocket motor, National Aeronautics and Space Administration and U. S. Air Force for the Texas Gulf Coast.

The new site would be situated for Nova and other very large rockets. Location favored is a coastal area east of Austin, a small island, situated approximately 10 miles between Galveston and Houston, on property belonging to the oil millionaire King Ranch. The site is approximately 50 sq. miles of Corpus Christi Bay.

Indications for the initial expenditure to acquire and prepare the new site would be approximately \$5 to \$6 million, with the completed facility costing in the neighborhood of \$1 million.

In addition to building Texas a focal point in the nation's developing solid-propellant industry, the site would bring solid-propellant boost motor manufacturers would build manufacturing support and assembly facilities close to the Army, Army Corps, United Technology Corp., General Control Rocket Corp. and Thiokol have been looking at sites in the vicinity of the proposed launch area and indications are that facilities would be located some 50 mi. north of the site near the coast.

Plus for the program in area being a number of other 50 sq. miles of other areas, to increase labor force and other problems and delays in firing the large boosters. Plans would be set on the Gulf with that stage launch occurring over water south of the Mississippi River and the remainder of the vehicle is in water holes passing through a 90 mi. wide so-called "water" between the tip of Florida and Cuba. Programs would involve some of the tracking and data acquisition facilities of the Johns Hopkins Univ.

The NASA Marshall Space Flight Center's industry competition for Nova over vehicle launch facility, such contract may be awarded in August, as the launch facilities to accommodate a liquid-propellant boost cluster and another for a solid-propellant boost cluster. Each launch complex apparently would provide for two pads.

The Texas launch site is situated to provide convenient water transportation of large-diameter components to the new "Polar Island" extending into Corpus Christi bay, northwest over 100 mi. offshore, from a protected island waterway.

Saturn Program Acceleration Planned

Washington—Production contract for the Saturn S-I booster stage will specify use of a government-owned plant in Louisiana and will be awarded by the end of the year, according to Space Administration 35 days after a 10-day conference to be held Aug. 3-4 at the plant.

Accelerating the Saturn schedule as an essential part of the current lunar landing program, NASA will call for S-I data after the conference at Marshall. It—about 10 or 12 months of Saturn development—will start a letter of intent in the winter for five days after completion of Ball. Contract probably will allow vehicle construction of two static test facilities about 20 mi. north of New Orleans on the Mississippi River delta.

General Dynamics/Automation and Douglas are leading contenders for the contract, and Chrysler's strength in its Mercury-Robinson lunar performance is in a project.

Initial aspect of the 200-ton S-I plant, a tank factory during World War II, will be one booster a month, leading to 90 units a year by the 1964 period.

Industry sources report that the plant's solid foundation is more than adequate for the weight of S-I, but that the 90-ft high test will probably have to be raised another 18 ft, in order for handling of the vehicle during liftoff.

segment areas probably will be enclosed no later than the end of next year.

Concurrently with these tests, trials will be conducted with smaller rockets to investigate thrust vector control.

Vehicle Configuration

The complete full-size configuration may include three segments, most likely eight, since more than one rocket pounds of payload per rocket will be required. An area at 10 at the full-size rocket size, to project it to be built by each contractor. First of the 10 full-size rockets may be fired as early as September 1967 with two or three, depending on the end of January 1968—a difficult schedule.

Following this, an Air Force/NASA probably will decide on one design, which will be evaluated in design verification tests by each contractor using the last three rockets of the series of 10.

Both contractors probably would participate in the follow-up production program for the single design selected. NASA probably will conduct its own tests with a cluster of eight rockets in mid-1968, with one of the contractors supporting some of the rocket motion. Following this, NASA will conduct direct thrust tests with as many as three or four of the rocket motion.

Profound Testing

Profound flight motion testing may be scheduled for the fall of 1967, with Air Force monitoring the program. Light rockets likely will be involved, but not the full-size rockets. The program will be completed by late 1968.

As first, responsibility probably will be shared by both contractors. The Air Force will be responsible for the rocket motion testing. NASA is expected to assume responsibility for the

launch of the rocket motion from the manufacturers and for any additional tests.

Immediately after the preliminary flight motion testing probably in June, 1968, the rockets will undergo tests to ensure that projected flight conditions will not preclude the possibility of an abort mission.

House Votes Funds For Military Construction

Washington—House last week voted \$412 million for military construction—40% of it earmarked for missile facilities.

The services already have over \$600 million in unobligated construction funds on hand.

The House approved \$282 million for the Minuteman solid propellant in tactical missile launchers, including \$270 million for support of operational demands and \$12 million for modifications to launch facilities at Cape Canaveral and Vandenberg AFB.

The \$512 million is divided Air Force, \$282 million; Navy, \$181 million; Army, \$151 million.

Air Force's request for \$12 million for mid-propellant booster test facilities to support the launch program was omitted from the appropriation measure passed by the House and is now before the Senate appropriations committee.

House appropriations committee passed action on the project until Air Force presents it with fine plans. USAF has submitted the plan, but in the House, it is still in the hands of the Air Force. The House Committee on the project would also start test facilities at Edwards AFB and launch facilities at Cape Canaveral.

• Aerospace questions environmental test

chamber, \$17.5 million. The facility, which will be located at the Arnold Engineering Development Center, will be for the testing of complete space vehicles under all space conditions having a significant change on performance, such as two-point, thermal radiation, vibration, and vibration. Radio Corp. of America has done the design work.

In approving the project, House appropriations committee observed: "It is a fact that the testing of whole vehicles will provide test data not presently obtainable by component testing and which can only otherwise be obtained by the very expensive process of placing vehicles in orbit and returning data by telemetry methods."

The facility will be constructed and operated by Air Force, but it will be available for use by National Aeronautics and Space Administration and the other military services. Despite Defense Secretary Robert Gilstrap reported that projects planned for testing in the chamber includes the Defense Department's Atlas, Titan, Minuteman, Scout, and Star, and the NASA program for the Nimbus weather satellite, including atmospheric observation, orbiting solar physical observation and orbiting solar observation. Tests will be scheduled on a basis of "as needed" by the user.

• Dyno-test test facilities, \$7.5 million. The bill would be for modifications of parts of Cape Canaveral to accommodate the launch vehicle.

• Naval Research Station, Sugar Grove, W. Va., \$16.6 million. This is to continue construction of the communications center, now approximately half completed. The House set a \$135 million ceiling on the total cost.

• New River concrete and design center for the Pacific Missile Range, \$5.5 million.

• Mines, \$5.5 million. This will provide tracking and control facilities for advanced development and testing of the ICBM during surface testing.

425L, 480L Systems Contractors Chosen

Washington—Air Force has chosen the Boring Corp. as system hardware contractor for development and production of the 425L command and control system for the North American Air Defense Command control system.

USAF also has selected Space General Corp., a new subsidiary of Aerojet-Centaur, as principal contractor for the 480L. Air Force's contract is for \$1.5 million.

North Corp. and Space Development Corp. are to be associated contractors for the system computer programing task for the 425L system, which will be installed in the Manned control center near Colorado Springs, Colo.



Breguet 941 STOL Prototype Flight-Tested

Report \$40.80 STOL transport has lifted 12 ft in flight and compare officials claim that the French-built aircraft has confirmed its performance. (The aircraft was tested on 12 ft in flight and compare officials claim that the French-built aircraft has confirmed its performance.)

AEC, Defense Awaiting Nuclear Test Approval

Washington—Atomic Energy Commission and Defense Department are awaiting approval from the White House to proceed with a series of 11 nuclear underground explosions to develop the detection device required for an effective nuclear weapons test program.

Approval on the program was presented last week to the Joint Government Atomic Energy Commission at hearings which highlighted the present energy capability to detect the underground explosions and the need for a new generation of nuclear weapons.

The Atomic Energy Commission's Board of Directors, Department of Defense, and the Joint Government Atomic Energy Commission are awaiting approval from the White House to proceed with a series of 11 nuclear underground explosions to develop the detection device required for an effective nuclear weapons test program.

The Atomic Energy Commission's Board of Directors, Department of Defense, and the Joint Government Atomic Energy Commission are awaiting approval from the White House to proceed with a series of 11 nuclear underground explosions to develop the detection device required for an effective nuclear weapons test program.

The Atomic Energy Commission's Board of Directors, Department of Defense, and the Joint Government Atomic Energy Commission are awaiting approval from the White House to proceed with a series of 11 nuclear underground explosions to develop the detection device required for an effective nuclear weapons test program.

The Atomic Energy Commission's Board of Directors, Department of Defense, and the Joint Government Atomic Energy Commission are awaiting approval from the White House to proceed with a series of 11 nuclear underground explosions to develop the detection device required for an effective nuclear weapons test program.

Minuteman Test Flight

Cape Canaveral—An Air Force Minuteman test flight was launched from the Cape Canaveral Air Force Station on May 19, 1967, at 10:00 a.m. The flight was the first of a series of tests to be conducted over the next several months.

The flight was the first of a series of tests to be conducted over the next several months. The flight was the first of a series of tests to be conducted over the next several months.

The flight was the first of a series of tests to be conducted over the next several months. The flight was the first of a series of tests to be conducted over the next several months.

The flight was the first of a series of tests to be conducted over the next several months. The flight was the first of a series of tests to be conducted over the next several months.

The flight was the first of a series of tests to be conducted over the next several months. The flight was the first of a series of tests to be conducted over the next several months.

The flight was the first of a series of tests to be conducted over the next several months. The flight was the first of a series of tests to be conducted over the next several months.

\$3,000 in downing, with a special pool on the second stage raising a number of downing—probably to test downing—of Nike Zeus rockets in Accretion Island.

Douglas Aircraft Co. has reported a profit of \$1,000,000 for the second quarter of 1967. Total net profit for the first six months was \$2,125,000 or 54 cents per share.

American Airlines' net earnings for the second quarter of 1967 totaled \$4,180,000, up from \$3,855,000 in second quarter 1966. Total net profit for the first six months of 1967 was \$2,540,000, down from \$3,410,000 for the first half of 1966.

West Germany is placing an order worth about \$125 million for the Army-Martin Peshing tactical missile system.

Skidway Aircraft has signed a technical cooperation contract with the Air Force under which Skidway will provide design, test and construction and in Skidway's Project 1210 helicopter program, primarily on rotor systems.

General Dynamics/Automation's operating time will have Air Force launch tests in revised operational procedures and is minor changes in automatic checkout and launch control equipment under a program called Golden Rendezvous. The program will be tested next month; it is expected to be completed by late 1967.

General Dynamics/Automation's operating time will have Air Force launch tests in revised operational procedures and is minor changes in automatic checkout and launch control equipment under a program called Golden Rendezvous. The program will be tested next month; it is expected to be completed by late 1967.

Soviets Plan Special Supersonic Transport

Aeroflot chief says fresh design will be developed, contradicting speculation Boudner will be modified.

By David H. Hoffman

Washington—Soviet Union's entry in the international race to fly the first civil supersonic transport probably will be an aircraft of fresh design and not a modified bomber converted to carry passengers.

Col. Gen. Yegor F. Logunov, chief of Aeroflot civil operations and head of Aeroflot, told *Aviation Week* last week that the problem of sustained supersonic flight demanded an original design concept. Gen. Logunov thus contradicted Western speculation that the Russians would adapt Boudner—a very large, high delta wing, supersonic bomber with intercontinental range (AW July 17, p. 31)—as a supersonic transport prototype.

Publicly displayed for the first time at the Tushino air show this month, Boudner has a wing fuselage-powertail configuration that some experts believe adequate for prolonged cruise at speeds between Mach 2 and 3. Photographs of the bomber touched off U.S. media speculation that the Russians would introduce a supersonic civil transport based on Boudner not later than 1980. A single Soviet prototype for such an approach exists, says both the Tu-104 trainer and Tu-124 twin turboprop transports now in Aeroflot service were once flown from Red Square to Moscow.

But Gen. Logunov, here in kind of the Soviet delegation negotiating a bilateral transport agreement with the U.S., said last week that "it was not correct" to use this aircraft in designing a supersonic transport strictly for carrying passengers.

Speaking through an interpreter, he said that it would be "more economic and useful" to design a civil supersonic transport in such form as the next.

Federalk U.S. Course

Gen. Logunov's assertions indicate that the Soviet Union is following a course, parallel to the one charted by the Federal Aviation Agency, for U.S. supersonic transport research and development. In recent speeches before congressional committees, FAA Administrator N. E. Halsey has said that sharp cutbacks in the S-700 business program would have little or no effect as long as a U.S. supersonic transport first came as type certificate. He said the supersonic transport program should proceed independently.

Commenting on whether the Soviet Union under its current Soviet Year Plan has set a supersonic transport first flight target date, Gen. Logunov said "not specifically." But he added quickly

that "we will not lag behind" and then reminded his government's claim that Russia would be the first nation to inaugurate service with such a transport, he said "but we will be the first."

Gen. Logunov, whose specific title is Chief of the Main Administration of the Civil Air Fleet attached to the Council of Ministers of the USSR, is the top executive officer of Aeroflot. Despite his high position in the Soviet hierarchy, he remains shorted of space and resources for his nation's aviation program growth and target data. He also declared constant on the main points at issue in the U.S.-USSR bilateral talks now under way in an atmosphere made tense by President Kennedy's firm stand on Berlin.

Soviet Fueljet

The Soviet Union has finally defined as far as it can after the International Civil Aviation Organization in the International Air Transport Association. However, Gen. Logunov reported that Soviet civil aviation authorities have made it a practice to attend important U.S.-U.S.S.R. aviation meetings and that these authorities are studying the material disseminated by the two aviation nations and that "there now exists a good business-like relationship" between ICADO and IATA and the Soviet Union.

Next two aircraft Aeroflot intends to introduce in scheduled service are the An-24, An-34 twin turboprop and Tupolev Tu-124 turbojet-biplane transports. At a May plane conference at Moscow's Vnukovo Airport (AW May 20, p. 31), Gen. Logunov predicted that the An-24 will be placed on domestic feeder routes this year and that the Tu-124 would follow "in the very near future."

But last week, he said that neither transport will carry passengers until, he hoped, sometime in 1985. Both are multi-engineable air landing freight within the Soviet Union as well as Aeroflot's policy of proving reliability and shaking down new transport designs in this manner.

Despite the airline's recent shipping on starting An-24 and Tu-124 aircraft, Gen. Logunov clearly indicated that Aeroflot is outstripping the goals set for it by the Soviet Year Plan that began in January, 1979. In 1979, for example, Aeroflot set its sights on having eight million passengers in 1985 (AW July 6, 1979, p. 34). Gen. Logunov said that the goal now is far too low. Although total 1980 bookings still have not been tabulated—such statistics are kept at the airports in previous years in Russia—the Soviet official said that Aeroflot carried "tens of millions of passengers" last year. Its goal, by contrast, was 21 million passengers.

Growth Factors

At the root of Aeroflot's explosive growth are at least four major factors. The Soviet government's policy decision to make the state airline monopolize the primary mode of national passenger transportation, the loss from charges by Aeroflot and the scrapping, about two years ago, of difficult classes of service on domestic routes, the airline's rapid transition to turbine-powered equipment, and the vast expansion of Aeroflot routes in outlying areas of the country.

In 1965, Aeroflot predicts that the jets and turboprops will carry 95% of its total traffic. Last year, according to Gen. Logunov, the volume was better than 95% and this year it has been increasing better than 95%. Regardless of this explosive rise in the airline's traffic, he said that more than half of Aeroflot's total traffic now are local routes, with only one deep route into service in a turbo-powered aircraft. Gen. Logunov also disclosed that:

- Aeroflot aircraft now are operating the vibrant Arctic and Antarctic routes, and to support Soviet scientific expeditions.
- Tu-114 service now is available on a daily basis between Moscow and Khabarovsk in eastern Siberia and as yet not a single regular delta jet has been ordered.
- Peak daily utilization in the Aeroflot fleet is about 12 hr. But this is subject to on transports assigned to fly long-range routes.



Soviet Turbofan-Powered Tu-124 Tested on Aeroflot Routes

Soviet Tu-124 twin jet transport, smaller version of the Tu-104 carries up to 60 passengers in three separate compartments for short- to medium-range stages. Soviet sources state maximum cruise is 1,000 km/hr (512 mph.) and cruise cruise is 500 km/hr (495 mph.) Airline now is limited service with Aeroflot in test Soviet turboprop transport. The engine, designed by Solovov, are tested in wing root nacelles. Aircr side engine are the wing, probably some fuel. Note engine engine engine.

Engineers Urge Changes in DC-8 Hydraulic Systems, Procedures

Washington—Flight Engineers International Union last week urged the adoption of new maintenance and operating procedures designed to prevent hydraulic malfunctions of the Douglas DC-8 hydraulic control systems.

The union suggested to both the Federal Aviation Agency and the Civil Aeronautics Board that the danger of dangerous hydraulic damage by double systems could be reduced by expanding the present emergency operation procedures to permit flight engineers, modifying the hydraulic system to prevent an irreversible loss of fluid replacing the present hydraulic fluid quantity indicators with a more accurate type of instrument and placing the hydraulic system controls on all DC-8s at the flight engineer's panel.

"During the July 12 investigation, landing of an Eastern Air Lines DC-8 at Miami, the pilot pointed out the emergency was caused by failure of a hydraulic hose on the number two engine and controlled that the crew could have noticed the hydraulic pressure slight but was not noticed from doing so under the airline's current operational procedures.

FAA hydraulic guidelines, authorized in a Feb. 15 letter to all DC-8 operators, were termed "too superior" to those of the past, but FEIA said that they are neither expanded and standardized by reduction in all emergency operational manuals. The more detailed procedures should specify test repairs approved for normal, abnormal and emergency situations, the union said.

Present hydraulic fluid quantity indicators on the DC-8 contain scale markings and auto readouts, fail to give an adequate picture of the amount of fluid remaining, fluid and do not give the operator enough accurate information to judge the severity of a malfunction or the size of a leak. The union called for an FAA membership director which would make conditions, the installation of a new type of indicator including readings for normal, abnormal and emergency fluid levels.

The union also suggested the addition of electrically operated hydraulic pump systems on each engine to reduce the flow of fluid to the pumps and prevent a further loss of the supply. Under the present system, FEIA said, fluid can still flow from the supply

servicing to the level in the line until the level drops below the normal supply.

To avoid the danger of seeing from the runway during an emergency, local way because of uneven air brake pressure, FEIA suggested that aircraft controls be tested off under emergency conditions. Building action and emergency landing in dependent on increased amount of accelerated hydraulic pressure, with auto readouts on each engine available to the pilot. Reversing the artificial control under these conditions could replace the warning hydraulic supply main device if excessive brake pressure is applied, FEIA said.

North Central Buying Routes From Frontier

Washington—North Central Airlines has reported Civil Aeronautics Board approval of the purchase of four aircraft agreements involving 35 cities and 1,975 miles on four Frontier Airlines.

North Central said the sale, if approved, will make its route system the largest of the local service airlines. The four agreements are in Montana, North Dakota and South Dakota.

North Central has said CMB that the route transfer would result in a \$451,000 annual reduction in its annual profit would increase by \$190,000.

BRITISH UNITED AIRWAYS CHOOSES THE SHORT HAUL JET



BAC ONE-ELEVEN

TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

**JET SUCCESSOR TO THE VISCOUNT
WITH EVEN BETTER THAN VISCOUNT ECONOMICS**

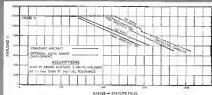
- 540 m.p.h. cruise speed
- 57 mixed class or 69 tourist passengers
- Short airfield performance
- Quick turn-round: built-in auxiliary power unit
- Cabin width for spacious five-abreast seating
- Range of over 1,700 miles with full 14,000 lb payload

BRITISH UNITED AIRWAYS HAS CHOSEN THE OPTIONAL LONG RANGE DEVELOPMENT OF THE STANDARD AIRCRAFT

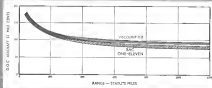
The BAC One-Eleven can carry its full complement of 57 mixed class passengers and baggage at 500 mph for stages of 1,200 statute miles with 100 hours service. It can carry 49 passengers for 1,000 miles.

These tables cover three separate methods of seating: ATA (1965), ATA (1969), SBAC and those of four airlines.

PERFORMANCE



WEIGHTS AND BALANCE



BRITISH AIRCRAFT CORPORATION
ONE HUNDRED PALL MALL, LONDON SW1, ENGLAND



Vigilant—Vickers' one man wire-controlled anti-tank weapon—can be carried into action by a single infantryman or paratrooper. Vigilant's auto-pilot control system gives high accuracy with the least training and precision. Vigilant makes no smoke or flash

to give away its position. The tank—brought down a mile away, perhaps—will never know what hit it.

VIGILANT



VICKERS-ARMSTRONGS (AIRCRAFT) LTD. WEYBRIDGE, SURREY. A Company of
BRITISH AIRCRAFT CORPORATION
 ONE HUNDRED PALL MALL LONDON SW1

8740

COMPACT



MOBILE



LETHAL



BLUE WATER is a tested, ground-to-ground guided missile, under development for the British Army.

BLUE WATER is powered by a solid-fuel motor for great reliability, and is fully guided for maximum accuracy.

BLUE WATER is a compact, self-contained weapon, making for minimum demands on gun-power and vehicles, and at the same time is accurate in counter-attacks.



ENGLISH ELECTRIC AVIATION LTD. A Company of
BRITISH AIRCRAFT CORPORATION
 ONE HUNDRED PALL MALL LONDON SW1

8741



Air Products processed in the application as well as the production of liquid hydrogen . . . the atmosphere that . . . for missiles and rockets. Examples, the test facilities for ICBM, and test facilities for even newer missiles. Air Products possesses missile propellant system capabilities for others can match. If you have a problem in propellant systems, look to Air Products for the answer.



REFUELING & SPACE DIVISION—General Office—Allentown, Pa. DISTRICT OFFICES: Boston, Ohio, Washington, D. C., Los Angeles, Gulf Breeze Park, Florida

—dashed" required in the test only—and the posed indicator both of which must be small, reliable, and able to operate with low power square waves.

• **Detective locations.** To determine the radiation level without indications of fine temperature patterns of control rods and reactor pulsations.

Radar and visual observations indicate the frequencies of neutrons to be about four times greater at dawn than in the evening, and for this reason a unit, always facing the earth, would protect the powerplant from neutron-radiation exposure. Argonne and its addressees, then, probably will be a requirement for information communications from the station, which also is given a powerplant site on the east side of the moon.

Argonne believes that a nuclear plant will be required to generate electrical power for an extended lunar expedition, such as surface operations, weather forecasting stations, television, radio, and other observations, physical observations and spacecraft reflecting stations.

Development of high power, high density, fast reactors for space use will result in "ultracompact" plants adaptable to marine, surface or other mobile use on the earth according to the Argonne report. The overall concept is based on research in constant because of its long use, but advanced concepts should be developed, Argonne said.

Among them are high temperature gas liquid metals other than sodium, high temperature fuels, structural materials, turbochargers and instruments too.

The lunar powerplant design is detailed in report ANL-6165 available through the Department of Commerce Office of Technical Services, Arlington, R. H. Anderson, J. C. Carter, H. H. Hansen, M. J. Janicik and J. F. MacArthur.

Spacecraft 'Bumpers' Studied by Convair

General Dynamics' San Diego Convair Division has begun a research program to establish design concepts for "bumpers" to protect space vehicles in collisions with meteoroids, under a \$54,000 National Aeronautics and Space Administration contract. The one test study is an extension of work already done by Convair in this field.

Impact velocities up to 20,000 fpi will be simulated by firing tiny steel pellets at copper, aluminum alloy, magnesium alloy, titanium and laminated and composite structures.

Techniques under development are expected to produce velocities up to 150,000 fpi.

machinability problem:

Materials complicated machining of mass-proportional phase for a control system hydraulic device. Most class causing tolerances without machining flaws but shock. First materials method that cuts cost more significantly.

solution:

A Westinghouse process investment control eliminated a complicated machinability problem for missile manufacturer Hughes Aircraft Company, Tucson, Arizona. Hughes is prime contractor to the USAF on the Falcon air-to-air missile. Materials competence at Westinghouse solves many aerospace problems. For example, Nimco high damping alloy exhibits fatigue in turbine assemblies — this gives Hypoco magnetic alloy strip diaphragms simple pressure design.

Repair special alloy performs well in missile control systems and torque motor. For data on magnets, magnetic alloys, refractory metals, conductive nuclear materials, investment and shell castings and conversion of your special material, contact the Westinghouse sales engineer. Or write, Westinghouse Electric Corporation, P.O. Box 564, Pittsburgh 30, Pennsylvania. Tel. CA 4-1200. J. G. H. Westinghouse

10000

Westinghouse





things are happening . . .

from northwest Florida down the Gulf Coast to Key West. This is the Eglin Gulf Test Range—a complex system of long-range tracking radar, telemetry receivers able to record over 300 items on one test, microwave networks and data-handling equipment. Its mission: testing the latest in medium and short-range missiles, space probes and advanced electronic countermeasures. Vitro operates the EGTR for the USAF Systems Command.

Vitro

VITRO LABORATORIES / Division of Vitro Corporation of America / 5150 S. W. 8th Ave. • WEST GARDEN, N. E. • DULWICH, FLA. 33007 • 305-455-0000 • 24 HOURS A DAY

British Study Solar Propulsion Systems

By Herbert J. Coleman

London—Advanced Projects Group of Hawker Siddeley Aviation has undertaken a series of studies aimed at evaluating designs of a lightweight solar propulsion unit using hydrogen as a propellant for rising a satellite from a low-circular orbit into a geostationary orbit.

The unit is designed for a family of launch vehicles based on Blue Streak, for a 24-hr orbit from which could have advantages for its vision, radio and telemetry communications links.

Two Group specialists P. A. J. Stokart and F. J. Swale, told the Foreign and Commonwealth Office that the U.S. group involving ion and glow discharges, particularly the Sunray nuclear reactor system, cannot produce of 15,500 lb in 24-hr orbit but added:

"Such satellites are beyond the present payload capability of proposed Eurogrip launch vehicles and it would also seem a waste to carry heavy sources into space where there is an abundance of solar energy."

Solar-heated hydrogen unit, in contrast to Hawker Siddeley, would be injected into a low orbit and a transparent plastic balloon then inflated. The balloon is covered with a large number of dots of less than 5 in. diameter and placed so that a hemisphere of the balloon is presented from an angle less than 10 degrees to the sun. Outside and inside of each dot has a high degree of reflectivity.

When the balloon is inflated it is suitable must be erected inside of this more correct balloon, less than 10 in. across at its top. The balloon, which rests on an integrated section, but at one end a sun-seeking device, controlling two sections gets. At the other end is a solar boiler shaped so that incident radiation from the sun on the spherical surface of the balloon has on even flux over most of its surface area.

Two-Cycle Operation

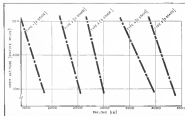
Solar energy is in two cycles:

• In first cycle, solar energy impinges on the outside of the balloon. Half the energy is reflected and half passes into the balloon. Of the energy entering the balloon, half is reflected and half is lost from the reflective dot on the inside, creating an intense flow at the surface of the solar boiler. Reversing half passes out again into space.

• In the second cycle, liquid hydrogen is fed to, pumped or pressure up the unit and through one of the nozzles to the solar boiler when it is vaporized. This passes back down the boiler core to the next, where division of flow occurs.



ROOM of solar power unit shown extended after insertion of most efficient plastic balloons.



VARIATIONS of Blue Streak launch vehicle and their flight regimes developed by S. E. Dunsen. It shows Siddeley Advanced Projects Group are: (Type 1) low-stage, using Blue Streak and Black Knight 1 (Type 2) same as Type 1, with addition of third stage using high net pressure and Scramjet of 210 sec specific impulse; (Type 3) liquid oxygen-fueled hydrogen third stage; (Type 4) Blue Streak first stage and liquid oxygen-fueled hydrogen second stage for 420 sec specific impulse and total weight of 20,000 lb; (Type 5) three stage vehicle for 300 sec specific impulse with equal velocity increments for second and third stages of 5,000 ft/s. Duration and thrust are assumed for an equivalent launch rate and notes that payload capability of 4,250 lb at 150 m altitude may possibly be obtained.

Major part of superheated hydrogen passes through a transfer tube to the expansion nozzle; some part moves to jets at the end of the boiler which are controlled by the sun seeker head.

Stokart who developed the particle for action and the sun-seeker moves toward the sun under the control system of the sun-seeker jets. Controls of the assembly allow complete sun-seeking capability while allowing the thrust axis

of the vehicle to be aligned along the flight path. Bidirectional balloons lie flat, allow unobstructed, passive orientation of the reflective surface.

There are a number of design problems, however, inherent with the proposal.

These include the following:

• Suitable plastic material for the balloon in use of high temperatures and pressures encountered. Available plastic

HERCULES makes airlift history down in Deep Freeze Land



During Operation Deep Freeze 1960, Hercules Ski-130s flown by the Air Force became the largest airplanes and first turbine-powered craft to touch down at the South Pole. Now the Navy has its own Lockheed Ski-130s to support America's scientific expedition on Antarctica. The Navy and its big propjet ski birds—

assigned to VX-6 squadron—set new South Pole airlift records every day, opening the frozen continent to complete exploration. Lockheed Aircraft Corporation, Georgia Division, Marietta, Ga.

LOCKHEED GEORGIA

to in Miles, as the Teflon seal line, of which the Brede equivalent is Teflon, inflation can be accomplished by hydrogen or helium gas from a bottle, or from a vent in the end's storage tank. Must can be created by a one-shot pneumatic or cartridge-operated snap plug.

• **Transition supporting the boom** is some development work to produce ratio scale efficient at 15K and 2,500K.

JPL Considers Vehicle to Return Lunar Sample to Earth for Study

Los Angeles—Sample of surface and subsurface material weighing one pound, collected by a mobile vehicle on the moon and returned to earth as an unmanned parajumped re-entry vehicle, could reveal critical chemical and physical data to facilitate follow-up manned landing experiments.

Analysis of the sample in a laboratory on earth would afford a degree of detail which could not be obtained with a limited amount of equipment on existing moon samples at the lunar site and transferring data back to earth.

Approaches to reduce this sample return are being examined by National Aeronautics and Space Administration's Jet Propulsion Laboratory in conjunction with Project Prospector. Study contracts are expected to be issued this year if the program proceeds as a follow-on to the scheduled nonmanned Project Surveyor payload (AW No. 30, p. 21) which Hughes Aircraft Co. is developing for NASA.

Project Prospector concept has not been defined for mobility because the future course of the unmanned lunar exploration program was doubtful as NASA waited for congressional approval of President Kennedy's proposed scientific and funding for the moon's moon program.

Now that the President's inaugural of the manned lunar program will be put into effect, it is possible that Project Prospector may be accelerated or accelerated. Acceleration of the program could emphasize demonstration of the feasibility of a logistics vehicle for supplying man and/or bases in the lunar environment.

Another possibility is that Project Surveyor's nonmobile concept may be expanded to include a mobile lunar vehicle sampling payload with capability for rocket return to earth. Under approach, a launch vehicle other than the Atlas/Cosmos probable would have to be employed to accommodate the substantially added weight that a mobile vehicle and its return-rocket would entail.

But even though specific requirements for Prospector's sample-return

at pressures reaching 10-15 atmospheres.

- **Reduction of solar heat transferred** to the tank, one method is to make the hydrogen tank surface highly reflective. Another is to insulate tank only with powdered or sheet plastic, such as Fiberglas or styrofoam.
- **Thrust vectoring**, in which the simplest technique appears to be development of a plug or bullet which would move within an inverted nozzle.

ing mobile vehicle and its sample return rocket have not been formulated and sound by NASA's Jet Propulsion Laboratory, indicates members attending to submit proposals to the expected competition are anticipating that the lunar mobile, manna originally contemplated will hold, and are projecting feasible schemes to bring lunar cost material back to earth with an unmanned re-entry vehicle.

Prospector's mobility concept possibly will be to explore a relatively small area—perhaps a few hundred yards—from the point of lunar touchdown, but even extensive roving of the vehicle in a sea and hostile environment would not be practical in initial experiments.

The vehicle probably would just creep to shift its position during sample pickup and transfer to the earth return vehicle.

Extended Probing

Initial estimates are that perhaps a period as long as an month of lunar exploration with a mobile vehicle may be programmed in contrast to the approximately 60-day human lunar now targeted to be achieved with the Surveyor soft-landed payload.

Key purpose of the mobile exploration probably will be to obtain a broad sample to indicate gradient characteristics on and under the lunar surface in order to determine if chemical and physical properties are relatively uniform.

Landing weight of the complete lunar mobile payload may vary between 4,300 and 6,400 lb., depending upon the capability required, and the specific deployment scheme once the payload safe-lands on the moon.

The soft-landed payload might itself be the mobile vehicle or the mobile vehicle may be another unit which separates from the main payload which would be returned and used for other lunar experiments, with mobile teleported to earth. One experiment projected for Prospector involves remote soundings, following, explores a change in soil to probe characteristics of lunar subsurface structure. An advanced lunar

NERV



From the first Nuclear Emulsion Recovery Vehicle (NERV) launch and recovery on September 19, 1969, came these important accomplishments:

Neutron Space Probe of a Recovered Neutron—The 85.6 ft NERV (29" wide and 21" high) was recovered after a 1200 mile-high flight into the inner Van Allen Radiation Belt.

Detailed Measurements of Space Radiation—A disc, 1/2" thick and 3" wide, exposed from the vehicle during flight, exposing a stack of 25 layers of special emulsion to the radiation particles. Recovery permitted scientists to analyze the emulsion directly.

First Re-entry of a Vehicle with a Recovery Surface—The NERV's re-entry nose cone, intentionally discontinuous to permit exposure of the payload, was the first "broken" surface to survive the intense heat of re-entry. Performance of the vehicle was successful in all respects.

General Electric's Missile and Space Vehicle Department designed and built NERV for National Aeronautics and Space Administration's Goddard Space Flight Center. MSRD is a department of the GE Defense Electronics Division.

GENERAL ELECTRIC

NERV is the National Aeronautics and Space Administration's accurate "cassette" to obtain a clear picture of space radiation. The Nuclear Emulsion Recovery Vehicle, built by General Electric's Missile and Space Vehicle Department, probed 1200 miles in space. It returned with comprehensive radiation intensity measurements from various altitudes and positions within the inner Van Allen Radiation Belt.

GENERAL ELECTRIC

deterrence

In Navy's Polaris missile system—a major contribution to free world defense—it's a matter of "as the submarine goes, so goes the missile."

Navigation systems manager for this deterrent weapon, Sperry has evolved a system which provides the navigational accuracies required over the weeks and months a submarine is submerged. An inertial guidance system, double checked by a complex of instruments and master computer, not only guides the submarine and pinpoints its position, but telegraphs directly into the missile the exacting data needed to start it on its way. Thus has navigation been called the key to undersea firings: one degree error in the sub's heading means a 20-mile miss for the missile. General offices: Great Neck, N.Y.



Other Sperry contributions to defense systems: precision acquisition, tracking and guidance radars for Navy's Torpedo and Tabor missiles, search radar system for USAF's F-4D, Army's Sergeant missile system, Sperry's Polaris submarine navigation computer (shown circled left).

SPERRY

telegraph system being developed by Columbia University may be used after the shock detection.

Using the three rods containing the sample would be pre-programmed along a three-inch trajectory for landing in a predetermined area to ensure survival of the lunar sample.

Soviet Scientist Claims New Venus Findings

Washington — Soviet astronomer Nikolai A. Kovalev claims to have proved that the planet Venus has a permanent atmosphere, and he has discovered a last definite indication in science—a constant browniness of the lower strata of its atmosphere which occurs within the clouds of that planet or lower down.

At the base of a new column the darkened portion of the sun's rays can be seen beneath horizon of a brownness caused by light reflected from the earth's atmosphere, structures observed on the darkened face of Venus had been described in an optical diagram.

The Prof. Kovalev told Leningrad scientists at Pulkovo Observatory recently. "I have succeeded in proving that this phenomenon is a fact, and the fact that it occurs because Venus has earth has a permanent atmosphere."

This unusual brownness of the dark side of Venus is caused by chemical processes. It must be assumed that this is a kind of burning of carbon particles which produce the brownness in the atmosphere, which can last in the atmosphere of Venus from carbon dioxide gases the process of auto-catalysis.

A Soviet news service, reporting the discovery and a scientific council has decided to publish Kovalev's findings immediately and to make further astronomical observations of Venus and other large planets.

Prof. Kovalev in the astronomer who claimed to have observed and photo-graphed a pattern common from the center peak of the sun's Altair star in November 1975. Based partly on this observation, he has declared that the sun's surface is of volcanic origin and that some are still active.

North American to Build Additional Little Joes

North American Space and Information Systems Division has a National Aeronautics and Space Administration contract to supply another two Little Joe boosters, bringing the total to six. Eight more were ordered in March 1964, but they are to be delivered in October and the next six weeks later.

noise problem:

Science the weathering system of a 75-deg refrigeration compressor motor aboard the submarine USS *Eden* class. Design a small, lightweight motor motor that's reliable, operationally reliable, unaffected by shock, vibration and corrosion.

solution:

Westinghouse designed and built a static motor controller for Electric Boat Division, General Dynamics Corporation, Groton, Conn. Completely silent. No moving parts. Oscillations in input allow for evidence of distortion or interruption of the 1-2 power to the motor. Unit is quickly and easily adjustable with no conventional electromechanical components. Response 1/2 cycle, faster than any controller available today. Rapidly changed electrical characteristics without vibration, even after 30,000 on/off operations. All parts hermetically sealed or encapsulated. To meet your specific electronic requirements, consult your Westinghouse sales engineer. Or write: Westinghouse Electric Corporation, P.O. Box 644, Pittsburgh 30, Pa. Tel. 412-251-1000. (C) 1975 Westinghouse.

WESTINGHOUSE

Westinghouse





Engineered Environment

Although vulnerable to heat, the satellite can blow itself a cooling bubble both and then "take" has environment to suit his needs.

Endurance of environment is a vital requirement that must be built into today's weapons systems. Answering this need is specially designed AAF equipment for controlled environment. For example, AAF equipment air conditioning was developed for the AFCEC system. The units are installed in mobile vans used for parachute checkout at the AFCEC facility. They provide conditioned air for personnel and for sensitive electronic equipment in the van.

Other AAF equipment supporting modern weapons systems include heating equipment utilizing various fuels as electric power, and packaged liquid chillers, heat exchangers, recondensed blowers. For any mission your system, reliability with AAF know-how and equipment.



DEFENSE PRODUCTS DIVISION
Aerospace Air Filter Co., Inc.
222 Third St., Rock Hill, S.C. Phone 703-721-1



Tower Tests B-52 Radar Antennas

Radar test tower, one of two CFB-high structures built by Kollsman at Waltham. Man for testing radar antennas used as B-52 bomb-igniting system. Each of the four test is lined with nonreflective material to duplicate free-space propagation conditions and prevent reflection of this sensitive energy. Roll-top-disk type door can be moved into position to protect equipment and engineers during bad weather.

from the latter precisely shaped. Efficiencies as much as 45% have been measured. RCA estimates that the solar cells will be available for space applications in 2 to 5 years. These would be best suited for use in orbiting space as means up to 3 kilowatts.

• **Atmospheric Research and Development Laboratory**—Research presently is being conducted on polycrystalline films deposited on non-thin substrates by decomposition of silicon ultrathin films in an atmosphere of hydrogen. Of several approaches, explored in external efforts, one has produced partial results, a laboratory spin-off research.

• **General Dynamics Astronautics**—Under an internally supported research program, the company is investigating photochemical conversion using photochemical synthesis processes. These materials permit reasonably high conversion efficiencies with efficiency up to 10% expected in polycrystalline form and can be deposited in thin film form on substrates with good characteristics, according to George J. Marks, head of the Electronics Research Laboratory. Polycrystalline films are preferred because they are less difficult to fabricate, and are less sensitive to stresses and other environmental influences.

Vacuum deposition and sputtering processes are under study. The former permits use of a variety of compositions

materials while the latter is more economical. Sputtering also permits direct coupling of working volumes between independent sputtering sources, thus, several materials may be deposited simultaneously and in sequence, an area being explored through each system.

Power density anticipated from this thin film solar cell work is 1 watt per sq. ft. Cool. Mailey says, it expected output to be about \$100 per watt with \$10 per watt regarded as a reasonable follow-on goal. A factor of 100 reduction in weight compared with conventional solar energy conversion systems may be possible. Films 4 in. wide and readily extended in length up per feasible.

This thin solar cell output, said, be available in 1971 up to 100 watts by 1985, larger area systems are feasible by 1985 for conversion systems to be placed on the lunar surface. Mailey predicts.

• **Mississippi Research**—Langston research program on polycrystalline silicon films, varying from 1 to 2 mils in thickness, has produced cells with efficiencies of 15%, open circuit voltage of 0.15 v., short circuit current of 1 to 4 milliamperes per cm. squared (AW Feb. 27 p. 69). Junctions are easily diffused into the film after deposition on one of several substrates.

• **Hitelec Corp.**—Compton sponsored study on thin film solar energy conversion devices is in progress and is expected to grow into a full research and



Satellite Solar Converter

Art's concept of solar energy converter which would have been used in orbit of cosmic therosphere. Thus, then existing convert flow through a fuel and converting heat to power. System is being developed by Electro-Optical Systems Inc. for the Project on Laboratory under \$100,000 contract. System, with 1/8-inch diameter collector, is designed to provide 115 watts of power for space vehicle operating in vicinity of Mars (AW Feb. 26 p. 12). Three views show converter in closed, unfolding and operating modes built to right.

development program in the future. • **Chas. Technology Corp.**—Compton is studying solar cell composed of multiple layers of polycrystalline films deposited on dielectric substrates. For power would be to boost efficiency (theoretically up to 15%) by depositing more layers each approximately one micron thick) one step the other into a multilayered cell, capable of absorbing all of the sun's photons. Effect would be made to align crystallites within each film so that they look like single crystals in depth of film.

• **Meck & Co.**—Epitaxial techniques developed for making p-n junctions have been applied to thin film structures and these are under study as solar cells. Single crystal silicon cells in this area of research have been made as large as 6 in. by 4 in. These are said to be as much as 1 sq. cm for evaluation of electrical properties. Companies continued research is concerned with applying the basic techniques of epitaxial growth to the production of thin film structures for light emission, light-tight and insensitive solar cells.

• **Hollman Electronics Corp.**—One of the products of Hollman Science Center long range experimental study of semiconductor thin films is the development of new techniques and materials for use in large area thin film solar cells. This work is presently concerned with silicon although other materials such as gallium arsenide are included. The program is built around polycrystalline films and uses chemical deposit and vacuum evaporation. Dr. Ralph P. Roth of the Science Center reports polycrystalline silicon solar cells in sizes up to 1 sq. ft. and pro-

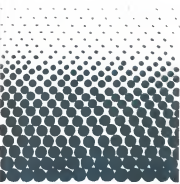
air density problem:

Design light, compact sensors to measure atmospheric pressure and density 125 miles up. Gages must withstand acceleration and vibration during ascent launch, yet be sensitive enough to measure thousandths of millimeters of mercury.

solution:

Westinghouse, built 30-cm sensors for NASA's Aerobics-Bi-Sounding rocket. One of these gages, tested at Wallops Island, Va., gives direct measurement of pressure and density as 30 to 125 miles up. With a sensitivity range of 1×10^{-4} to 1×10^{-6} mm of mercury, the gages are expected to record data in the thin atmosphere of near space. To achieve this, Westinghouse developed tube elements of extremely low mass, as well as new techniques for measuring them. For help in solving your sensor problems, contact your Westinghouse sales engineer. Or write: Westinghouse Electric Corporation, P.O. Box 888, Pittsburgh 30, Pennsylvania. You can be sure of it at Westinghouse.

Westinghouse





Satellite communications test procedures are required on the remote solar cell (in shaded area) of Bendix Air Force Systems Division. The 15 x 20 micron cadmium sulfide cells, at a 1000-ohm resistance.

REMOVING "HOT SPOTS" from electronic packages is a prerequisite to achieving the reliability required for advanced satellite communications systems. Individual components—resistors, transformers, capacitors, transistors—must be mounted so as to duplicate in space the same thermal environment for which expected MTBF values have been established in the laboratory. This thoroughness in developing and testing electronic circuits, with special emphasis on heat transfer, is a key to Bendix reliable space communications equipment. Our team of communications experts is in the forefront of this advancing space technology. Positions on this team are open to better scientists and engineers.

BENDIX SYSTEMS DIVISION
ANN ARBOR, MICHIGAN



volting efficiency from 5 to 50% to be added, from this program will be seen.

• **General Electric**—This film polycrystalline cadmium sulfide and silver solar cells are being investigated by the Advanced Research Laboratory of General Electric. Dr. James F. Elliott is leading the program (AWE Oct 17, p. 61). Work is supported by Air Force Aeronautical Systems Division and the Army Signal Research and Development Laboratory. General Electric is preparing films of silver by chemical deposition and cadmium sulfide by evaporation. Both processes, according to Elliott, lend themselves to a continuous manufacturing process. Determining what the electrode configuration will be for the total power supply is a major engineering problem.

• **Hanau Chemical Co.—Cadmium sulfide** film cells with direct sunlight conversion efficiencies up to 3.5% have been selected in various experiments on various tested substrates. Cadmium sulfide films formed from packed and deposited cadmium sulfide single crystal chips are microcrystalline but the cells are inefficient, have reactivities less than an ideal and good optical transmission. Back cell cells have been made from these films deposited on conducting tin oxide coated glass employing the same laser forming process in used on single crystal cadmium sulfide cells. Backwell have refers to the conversion process near the incident surface followed by diffusion of charge carriers to a barrier in the neighborhood of the surface. Work is supported by USAF Aeronautical Systems Division contracts. Solar energy conversion efficiencies up to 4 or 5% are expected to come about with better, modified processing.

• **Lang-Campbell's Solid State Physics Laboratory** has studied the applica-

tion of its patented process to thin film solar cell fabrication. David William Adams, manager of the laboratory, feels that the thickness of thin solar cells will have to be a compromise between two conflicting requirements. One is to restrict film thickness to 5 microns to achieve maximum sensitivity to incident radiation. The other is the need to have films at least 35 microns thick for efficient conversion. As a possibility for reducing efficiency at thicknesses less than 35 microns, Lang intends to investigate light-trapping techniques which will enable light to pass back and forth through the film.

Early thin film solar cells might be

available for space applications as early as next year, Martin Wolf says. These cells, however, will have efficiencies considerably below those of conventional silicon and gallium arsenide cells and their reliability will be an unknown factor. They might be used with in-flight insurance of the associated expense in successful flight type.

The thin film solar cell power supply will not be useful where the total surface area is the limiting factor as it is in present satellite configurations. GE's Wolf expects that thin film cells could find space application where power is the order of a thousand to a million watts as desired.

A REPUTATION BUILT ON SERVICE



WATER SEPARATOR



SWIRL SHELL



AIRCRAFT DOOR



DIVER VALVE



ACCESS DOOR



PROPELLER SPINNER

WRITE FOR BROCHURE DETAILING COMPLETE LAYELLE SERVICES
ENGINEERING • PRODUCTION PLANNING • SHEET METAL FORMING
WELDING • MACHINE SHOP • METAL FINISHING • QUALITY CONTROL



LAYELLE AIRCRAFT CORPORATION • MEADOWTON, BUCKS COUNTY, PA.
Between Philadelphia, Pa. and Trenton, N. J.



Height-Finder Radar

ANVTTS-26 high power height finder radar of Hunter AFSC Co., is first of new production units to be turned over to North American Air Defense Command. Built by Avco Electronics and Ordnance Div., the FTS-26 system is housed in 55 ft-dia. radome,



PUMP PRIMERS

ARTHUR A. NICHOLS

VALUE ANALYSIS REVEALS GENERATOR'S UNIQUE ASSETS

► The end user unusual qualities of the Generator pump which have kept it consistently in demand with aircraft propulsion engineers from the days of the initial superchargers for piston-engined engines was first recognized as inherent adaptability and high reliability.

► The Generator pump is a positive displacement type, delivering a predetermined amount of fluid in direct proportion to speed. It is a form of integral gear pump—simple and compact in basic design, (has only two moving parts). It is lightweight, vibration-free, provides exceptional performance at high altitudes and has low wear over a long service life. In addition, it is balanced and economy orient in operation.

► Structure and operation of the Generator pump is related to its design. The moving elements are the "bottom Gears"—stator and rotor. Both turn in the same direction and either one may be driven. The inner element, the stator, has six teeth. The outer and the rotating rotor, likewise a stator is driven over the fixed from the inner or stator part in the opposite part. (See below).



► Valuable design lessons abound in mechanical structure associated with the operating considerations and some of the major problems inherent in valve construction.

► Applications for Generator aircraft pumps lie in the range of pressures up to 3000 psi. They are suitable for low pressure hydraulic and servo systems, pneumatic motors, tube, hose, and flexible service, and engine control systems in aircraft and guided missiles, and marine applications.

► Technical data is available and your inquiry is invited. Write:

W. H. NICHOLS & CO.

Makers of Zetlich-Manning Pumps and the Nichols Milling Machine.
"The mill that runs its head!"

48 WOOD AVE., WALTHAM 24, MASS.



WELDED HONEYCOMB MODULES developed by Sperry Gyroscope for high-density remote control packaging is equal to any fabrication and component replacement as well as in-service performance and reliability. Metal or plastic blocks are cast or drilled to accommodate all components which then are interconnected by welding. Exposed ends are then encapsulated in seal coating.

Welded Honeycomb Modules Simplify Component Replacement

Philadelphia—One of a performed metal or plastic honeycomb structure to house components used in high-density welded circuitry offers important advantages over sandwich type construction using glass as this Sperry Gyroscope engineer Charles W. Johnson said here during the recent Institute of Radio Engineers conference on production techniques.

Sperry Gyroscope has adopted the welded honeycomb structure technique for high-density packaging in a number of atomic systems now under design by the company, Johnson reported.

Although neither welded circuitry nor honeycomb structures for housing components are in themselves new, the combination of the two is expected to ease a number of previous welded circuit manufacturing and reliability problems, Johnson indicated.

Sperry's approach is to use small metal or plastic blocks containing holes which have been drilled or cast into the block. Each hole diameter matches the component which will be inserted into it. After component insertion, capillary discharge welding is used to interconnect individual component leads into the required circuit on opposite sides of the honeycomb block. When circuit is completed and has been tested, the entire unit can be sealed by vacuum encapsulation.

Johnson described some of the manufacturing problems that occur with the more familiar sandwich type welded circuit construction and how these are eliminated or minimized with the new honeycomb structure.

► **Accessibility.** In sandwich type circuit structures, replacement of a defective component is extremely difficult since the sandwich has been completed and wired but is relatively easy with the honeycomb structure.

► **Component insertion.** In sandwich type construction, all components must be inserted before welding interconnection can be made, resulting in a waste of component leads and the increased possibility of wiring error. With honeycomb, components are interconnected individually as they are inserted. This saves solid circuit board sequence, as compared with an intricate, weld-all-at-once plan, this provides more accessibility for the wiring electrode.

► **Component variations.** Separation between the body of adjoining components, which determines their inter-component capacity, can have an important effect on circuit performance. In sandwich type construction, this separation is determined by the location of the axial leads on each component which is subject to considerable variation.

With honeycomb construction the position of each component both is controlled by the predrilled or cast holes which can be inserted more precisely, according to Johnson.

► **Reliability.** Encapsulation of a solid web construction must be made to support stresses on components, not easily divisible, which avoid component failure. Additionally, insulative voids in the encapsulating material can cause hot spots to develop which also avoid component failure. With honeycomb construction, the major portion of the encapsulation is in place before the components are inserted so that final encapsulation to conduct the fine ends should not produce important stresses and voids are minimized.

Johnson pointed out that, "In addition, since the feed-through wires can be cut at the honeycomb block and their grooves can be cut on the surface to provide convenient connections without shoring or in crossing the over-all module dimensions. Where considerable heat must be dissipated from the circuit, conductive films may have been blocks can be used to improve conductive cooling."

The honeycomb technique can be incorporated advantageously with other thin-film circuit techniques, including integrated microelectronic circuit packages, merely by using holes of the required shape. Johnson and other Sperry had adopted the welded honeycomb construction after evaluating about a dozen different packaging techniques.



Solar Generator Model

Solar thermo-electric generators, using zero fuel reflection, a pilot model of a 150-watt space power system which Westinghouse Standard Division of United Aircraft Corp. will deliver to Air Force. Reflectors are attached to equatorial mount to automatically follow the sun. (Image is reflected in photograph standing on a holder.)

navigation problem:

Proves loss of directional power supply for SINS (Shipboard Inertial Navigation System) for surface submarines.

solution:

Westinghouse is delivering static navigation to the Navy to take the place of major generator sets previously used in SINS. Since SINS could conceivably swing out of calibration, all direction and position reference could be lost. The reference would have to survive to recalibrate. So the Navy turned to Westinghouse for solid state navigation, and for the first time in the operation phase of SINS. These unique systems have no moving parts. They permit lower noise operations and reduce maintenance while helping SINS equipment maintain stable and absolute directional accuracy. Contact your Westinghouse sales engineer in your challenging electronic component problems. Or write: Westinghouse Electric Corporation, P.O. Box 505, Pittsburgh 30, Pennsylvania. You can be sure... if it's Westinghouse.

WESTINGHOUSE

Westinghouse



The stockholders of Chance Vought Corporation and Ling-Temco Electronics, Inc., on June 30, 1961, approved plans for combining these two companies into a new company — Ling-Temco-Vought, Inc., to be effective August 31, 1961.

Combination of these dynamic, experienced organizations will bring depth of capabilities with depth of management to meet the advanced challenges of electronics, space communications, aircraft, missiles, industrial and consumer developments.

Ling-Temco-Vought will employ more than 20,000 people in seven basic groups: AERO SPACE SYSTEMS, ELECTRONICS, COMMUNICATIONS, COMMERCIAL AND INDUSTRIAL PRODUCTS, SOUND SYSTEMS, AERO SYSTEMS, INFORMATION HANDLING SYSTEMS.

This will be — Ling-Temco-Vought, Inc. — a new industrial leader to serve America's exciting future through science.



From left:
James J. Biggs
Chairman of the
Board
Robert W. Hall
President of the Board

Walter L. Johnson
President

John W. Brown
Executive Vice President

L I N G - T E M C O - V O U G H T , I N C .

LTV

REPORTS
MANAGEMENT
FOR PROGRESS
IN AEROSPACE
ELECTRONICS
COMMUNICATIONS
CONSUMER PRODUCTS



Laser Demonstrated

Optical parametric oscillator which was believed not even to produce coherent light of wavelength of 1.45 microns in the infrared region, has been demonstrated by the Thomson Research Division. The device which weighs about 50 lb. is similar in principle to gas lasers developed by Bell Telephone Laboratories. Krypton lasers built up low-power lasers derived from it permit easy replacement of critical parts.

Ring Builds Amplifier For Project Artemis

Large, water-cooled, silicon amplifiers designed to power a vector transmitter used in the Navy's Project Artemis has been built by Ring Electronics Division of Long Beach Electronics.

The silicon amplifier and related equipment for Project Artemis have been installed in a transport Navy trainer, the USNS Mission Capricornia modified to carry high-power equipment. The ship is fitted to raise and lower the transmitter which is five stories high and weighs over 40,000 lbs.

Mission Capricornia is operated by the Voltaire Sea Transportation Service, for Office of Naval Research, and it will cruise in the Atlantic Ocean during summer.

Radco Laboratories of Columbia University is prime contractor on Artemis and some 70 aerospace, government and industry organizations are involved in the advanced Navy anti-submarine warfare project.



• **Solder Cell Splices**—In an effort to reduce noise present for a given amount of surface area from solder cells, Hoffman Electronics has been studying the use of splined duplex solder cells. The splines are on the order of millimeters in diameter and a multiplicity of these made by corrosion-free diffusion techniques, can be incorporated. Value of the approach lies in the fact that as noise, half hemisphere rather than a

flat surface, may be exposed to sunlight. This would reduce the power density but lower the strength per area. Studies have been supported by the Army Signal Corps.

• **Tritan II Site Communications**—Series of field equipment tests of UHF communications was conducted during the past year for the Air Force by Electronic Communications, Inc., in anticipation of requirements for Tritan II site communications system. Company is charged with determining feasibility of using low elevation antennas (5 to 12 ft) to communicate with the known along trajectory short paths (70 to 100 mi) at moderate UHF RF power levels (up to 1 kwatts). In tests conducted at McClellan AFB, Wichita, Kan., a suspended path losses for identical transmit and receive (ap axis) using vertical polarization were within ± 10 db of predicted values, whereas horizontal polarization figures exceeded predicted values by several orders. Monitoring directional stability and cluttering and lowering elevation above a 10 ft elevation was difficult because of high noise in Wichita area during low clouds and such spring when tests were conducted. Present tests were conducted by Electronic Communications in the vicinity of St. Petersburg Fla. and Davis-Monthan AFB (Tucson, Ariz.). Summary of results of company's tests were provided by Air Force to each company, following a bid to contract completion for Tritan II site common antenna system (AW July 30 p. 19).

• **Earth Current Communications**—Selected UHF/GW—Use of earth currents (AW Mar 30, 1959 p. 36) for transmission of electromagnetic energy appears to be gaining favor with the Air Force for some of its intended missions. These are indicated Air Force may select earth current communication antenna for its 450L and 477L command and control. Earth current systems refer to those which have transmitting and receiving antennas buried in the earth. These encompass two basic approaches: the transmission of energy directly through earth strata or via surface waves at the interface between the earth and the air. A review of the latter type is being held by 50th Army for communication among Manassas ICBM sites.

• **Signs of the Semiconductor Times**—Among recent indications of tightening in the semiconductor business (AW June 12 p. 71) are the following: • **Transistor Electronics Corp.** indicates first quarter 1960 (ended June 24) sales figures were \$5.5 million based on assembled figures, compared with \$12.6 million for like 1959 quarter. Fiscal 1961 sales apparently near \$39.5

million, down from \$17.7 million in the previous year. Semiconductor products account for almost all of the sales of this company, total the second largest semiconductor manufacturer in 1959.

• **Several important developments** are aiding potential customers to maximize their output with available glassware semiconductor devices.

• **Hoffman Electronics** will develop and transfer R&D, putting more emphasis on high power rectifiers, wave diodes and controlled rectifier while maintaining current transistor lines. Company is completing proposals for its power devices in El Monte, Calif. plant, high-power device in Danbury, Ct. locally.

• **Continuing drop in transistor prices** is reported to be pushing most of its production. President of one semiconductor firm noted stockholders that future is still bright in semiconductor business, another president predicts an appreciable downturn in next four years.

NEW AVIONIC PRODUCTS

• **Midget low-noise choppers**, Model 40, designed for 400 cps rate, can with stand 100g shock and vibration in an enclosure from 18 to 50 cps and 10g from 55 to 2,500 cps, according to manufacturer. Signal level is up to 10



v d.c. at 2 mV maximum percent. They actually rated can operate over temperature range of minus 55C to 100C and has useful life of more than 3,000 hr. Chopper weighs 5 grams and measures 1 1/2 x 1 1/2 x 1/2 in. Manufactured by Agap Electronics, Inc., Cambridge Division, Cambridge, Md.

• **Semiconductor rotary switches** come in standard 3 in. diameter size. Series 7600 provides 12 line switching contacts and 4 poles per deck, while Series 8000 provides up to 24 switching contacts and up to 5 poles per deck, using contacts on the front and back of the disk. Switches employ MIL standard quality materials, deck wafers are made

reliability problem:

Drastically reduce downtime of T-R units in aircraft. Achieve a high degree of reliability. Increase operating time by reducing unscheduled removals for maintenance. Keep cost of equipment compatible to conventional units.

solution:

Westinghouse furnished silicon power module cells for use in new transistor-resistor units. These units have had only one recorded removal in 100,000 hours operating time. Best operating performance by previous units was 20,000 hours between unscheduled shutdowns. The Westinghouse T-R units are used in the C-130A and C-141 aircraft manufactured for the Air Force by the Lockheed Aircraft Corporation, Marietta, Ga. Each unit converts 115-volt, 17.5 ampere, 400-cycle power to direct current at 27 volts and 200 amps. Compared this moved with a vacuum-tube unit that performs the same function. The use of the static transistor-resistor eliminates moving parts that would otherwise require changing of brushes and bearings every three months, changing the rotor thirty times, in a comparable 100,000-hour life period. Ideas and products like this one can save you man-hours and man-hours more while holding your reliability results. Contact the Westinghouse sales engineer. Or write: Westinghouse Electric Corporation, P.O. Box 660, Pittsburgh 30, Pennsylvania. The one to use... if it's Westinghouse.

0-10000

Westinghouse



BLAISDELL Announces the addition of LAMINATED



LAMINATED BRASS has now been added by Blaisdell to their line of laminated aluminum, 1010 steel and 301-302 stainless steels. Laminated brass available as stock item 12"x48" width to 24" available as special order. For further information, write:



BLAISDELL MANUFACTURING CO.

1342 Colorado Ave. • Office 5-6474 • Telex 3644 • Calif.

This is systems capability at NAA-Columbus

Many of the significant advances in electro-mechanics, electronics systems, environment systems, and other areas, were originated and brought to fruition at the Columbus Division of North American Aviation. A complete center of advanced systems technology, the Columbus Division has the minds and facilities to convert original concepts into practical hardware with economy and efficiency. This is true systems capability... this is the Columbus Division.

COLUMBUS DIVISION OF NORTH AMERICAN AVIATION



Columbus, Ohio



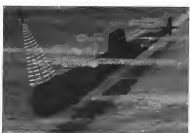
WIND TUNNELS NAA-Columbus has one of the largest wind tunnels V-22s design testing sections in the world (14 feet wide by 14 feet high). This is part of the extensive V-22s facilities Columbus has used in the development of both lift-lift and tilt-rotor aircraft which need no runway for take-off or landing.



SOME CITY NAA-Columbus is building the complete Army Redhead-Redrunner target missile system. This converted new missile will fly automatic or supervised missions and will operate at altitudes up to 60,000 feet.



"HAYSTACK HILL" ANTENNA A 280-ft. antenna system, using a new concept that distributes tension evenly to avoid distortion in redesign, is being built by Columbus for USAF on Haystack Hill near Boston, Mass.



ANTI-SUBMARINE WARFARE NAA-Columbus is at work on new applications of anti-submarine warfare to meet the threat of highly advanced submarines. Other research and development projects at Columbus include advanced battle-field surveillance, and surface-to-air and surface-to-surface missile systems.



THYRISTOR A small glass tube thyristor and diode tube is made of Silicon Grade L-4. Both series are available in short and long lead times. Manufacturer: J.E.C. Instruments, Inc., 137 Hamilton St., New Haven 8, Conn.



PORTABLE TEMPERATURE CHAMBER Model 1050P, for rapid temperature cycling has a test chamber measuring 10 x 7 x 7 in. Temperature can be cycled from -100°F to 500°F in less than 12 min. with temperature control accurate to within 1 deg. F. At -100°F temperature, device consumes less than 34 lb. of carbon dioxide per hour. Test chamber weighs 40 lb. Manufacturer: Delta Design, Inc., 3163 Adams Ave., San Diego 34, Calif.



ANALOG/DIGITAL SHIFT CIRCUIT The 11, contains all required logic circuitry within the counter package. Model shown, the ADC-1111, employs binary V-22s, self-selecting logic circuitry with silicon switching diodes for non-saturating readout. Device uses 54-bit and 54-bit data to obtain its 11-bit output, or 2,048 count output. Accuracy is 1 of the least significant digit and resolution is one revolution in one part in 54. Encoder weighs 2 oz., measures 1 1/2 in. in diameter and 1 1/2 in. in length. Manufacturer: Condor Controls Corp., 118 Duffy Ave., Hicksville, N.Y.



Formation of three Antonov An-12s—the best amphibious transporters in the world—flies by at the Tushino air show (ANF July 17, p. 26, July 24, p. 26). Flaps are partly extended and rear doors are opened prior to dropping paratroops (above). Parachutists have nearly cleared the An-12s (below). Interchangeability of the military and civil An-12s is substantiated by the construction of markings.



An-10As, An-12 Drop Chutists at Tushino

Antonov An-12 drops paratroops in practice rehearsal. An-12, developed as the military version of the An-10, does not have the anchor line on the stabilizer or the control fin of the An-10 and has a modified rear fuselage tail for rear loading and fitting of a tail turret. Parachutists are landing in a right side down, not rear, however. Both An-10 and An-12 have negative dihedral in the wingtip sections outboard of the engines. Below is parading An-12s.





Production modifications of the Yakovlev Yak-141 (above) include ragged inlet spikes and large bounding ribs in the belly. Note lead glass, laminar (above) does not have the same. Earlier Yak-141 (below left). Seven in previous aircrafts but neither spiked inlet nor bounding ribs. Yak-141 is in attack position.



Rocket launcher used for island (from and field) by Mexico (above) appears to be a shorter unit than one demonstrated at Tashiro (above, right). Flame pattern (below) suggests use of two small units instead of single large unit at Tashiro (AVR July 17, p. 27).



PRODUCTION BRIEFING

Craft Corp's AirResearch Mfg. Division, Phoenix, Ariz., has received a \$5 million contract from the Airer to produce small gas turbine gas engine sets for the Sergeant missile surface vehicle.

Talley Industries, Mesa, Ariz., has completed preliminary development of a solid propellant gas generator to open the Mariner's air stream, prior to its main thrust motor. A \$10,000 contract from The Boeing Co., Tulsa, has secured an additional \$77,000 contract from Boeing for further development and qualification of the unit.

Webster Aircraft Corp., Redbank, Calif., will manufacture "aircraft" and "aircraft" Designing Service Inc. Center Line, Mich., will produce wing spars and chords, wing and body structure, and floor beams for the Boeing 737 series recently awarded contract.

Ross Aircraft Co. is supplying U.S. Army with two prototype Model 124-E. Features a special configuration of the QTC, modified for various air-takeing in the Nike and Hawk missiles, as well as the Nike infrared-guiding missile used in ground troops against low-flying aircraft.

Sermon Corp., Redbank, Calif., will supply aluminum aircraft windshields for advanced turbine-powered Boeing Model 107 helicopter. Product of a two-year R & D program, the "Sermon 900" plastic windshields are tested extensively in a special testing device by Sermon.

Telconforming Corp. will supply spring-mounted substation protection for the Mark 44 torpedo under a \$700,000 Navy contract. The gun mount will be used for cruise control during the short interval of time when the torpedo first makes its entry into the water.

Conair Aircraft received a \$7 million (194) contract for T-77B transport aircraft, the delivery to avoid foreign competitors under U.S. Military Assistance Program auspices. The second export contract on the T-77B transport production of the firm's rate mid 1963, with initial deliveries to be made on this order in February, 1962.

Aircraft Development Co., subsidiary of Marshall Industries, Pasadena, Calif., will supply the Aero D-5 four-stage solid propellant rocket vehicle for NASA's Navy IF experiment. Company also will supply engineering support for ground recovery.

shock problem:

Supply accurate, shock-resistant windshields for Nike-Zeus control panels. Make them absolutely precise, yet rugged enough to withstand extreme shock. Eliminate the degrading friction of the standard print.

solution:

Westinghouse furnished Commercial Electronic Manufacturing Company, Dallas, Texas, with "Trust Board Suspension" windshields for the Nike-Zeus control system. "Trust Board Suspension" is a tough metal band about one-eighth the thickness of a human hair. It shows no conventional joints and bearings, makes possible an extremely rugged unit with almost infinite repeatability. They bear overload up to 150 times the full-scale deflection and withstand extreme vibration and shock without reducing accuracy. Appearance is attractive, conducive to quick legibility. If you need this kind of reinforcement in your current project, call your Westinghouse sales engineer. Or write: Westinghouse Electric Corporation, P.O. Box 668, Pittsburgh 30, Pennsylvania. You can be sure... if it's Westinghouse.

A-1000

Westinghouse





Model of civil twin-turbine Soviet Yak 24P helicopter is displayed at Soviet trade fair in London. Closeup below shows detail of the Russian rotor hub on model. Helicopter apparently is a follow-on to the AN-32 inflight-capable transport Yak 14C.



Soviets Display Helicopter Models At London Exhibit

Models of Soviet Yak-24P and Yak-14C helicopters in London after workings were exhibited at the Soviet trade fair in London. Yak-24P would carry 30 passengers seated two-above on standard side with single row of seats on port side. Entry is through port door at right door and via ramp lowered from tail. Service air maximum speed is 320 mph, cruise 312 mph, range 185 mi. Yak-14C model (below) would carry 50 passengers in three-above and two-above seating. Tail rotor would be 70,000 lb., maximum speed 210 mph, cruise 340 mph and range 310 mi.



SPACE AGE IMAGINATION

FRUEHAUF... TRUSTED NAME IN GROUND SUPPORT EQUIPMENT



Ryan Firebee jet target being launched from a Fruehauf launcher.

Fruehauf—one of America's most experienced designers and producers of space-age Ground Support Equipment

Space age imagination—the ability to conceive, develop and produce Ground Support Equipment to successfully meet the challenge of tomorrow! Since the early space probes Fruehauf has been a proven producer of a staggering number and variety of imaginative ground handling equipment. Fruehauf's versatility ranges from transporters and containers to jetway electronics, vans and launchers such as the near-eye length launcher recently produced for Ryan Firebee jet targets.

At your service are 11 strategically located Fruehauf plants across America—over 2,000,000 square feet of space available for U.S. E. production! Fruehauf personnel have worked on over 500 different types of units, many completely conceived, developed and produced by Fruehauf's highly skilled military oriented specialists, men with years of proven experience in the field.

Fruehauf has produced the most famous equipment for:

Airline	Nike Apogee	Seaplane
Bombardier	Wallops	Naval
Copeland	Atlas	Aviation
Deere	Paladin	Missiles
Bedford	Rollins	Anti-aircraft

Yielders for Army, Air Force and Corps of Engineers

PHONE OR WRITE FOR A



Fruehauf represents the line you can place directly, as well as through D.D.E., Fruehauf's sales dealer who buy and sell for you.



Photos in the Box and Wheel

MILITARY EQUIPMENT DIVISION — DETROIT 32, MICH.
MISSILE PRODUCTS DIVISION — LOS ANGELES 58, CALIF.

fault protection problem:

Positive-failure elements in case of accidents. Replaceable mechanical devices with smaller, more compact, support more efficient fault protection for a given size, then the saving costs and unnecessary downtime.

solution:

Westinghouse supplied Krypton Company, Waltham, Massachusetts, with Type 536 (hydrocarbon) miniature circuit breakers for use in 115V ac main circuit and motor controls. These fail-safe breakers are dual in ground in oil-filled enclosure and electronic equipment where mechanical equipment is required. Small, compact design allows protection of electrical equipment under such range of operating temperatures and stringent environmental conditions. Available in a variety of tripping characteristics: standard undervoltage, short-time delay, instantaneous trip. Available from 20 milliamperes to 40 amperes with maximum voltage range 250 volts ac or 10 volts dc for helpful drop loading on a discontinuity in the load characteristics. Tripping principle: contact under Westinghouse video exposure. The same Westinghouse Electric Corporation, P.O. Box 304, Pittsburgh 31, Pennsylvania. For more details, call or write Westinghouse.

Westinghouse



"Forging Military Spacepower"—

USAF SYSTEMS COMMAND ISSUE

September 25, 1961

First complete
details on newly
formed Systems
Command

Future Technical Activities
Organization
Plans & Programs
Procurement

ABC ABP

AVIATION WEEK
and Space Technology

A McGraw-Hill Publication
330 W. 42nd St., N. Y. 36, N. Y.

Real Experience



Sonic Doppler System Marks Descent Rate

New York—Finnish development of rate of descent in helicopters is provided by an airborne ultrasonic doppler system under evaluation at Wright Air Development Division. The system was developed by Gellert Industries, Menasha, Wis.

Vertical velocity at touchdown is the basic parameter governing flight vehicle structural loads on landing impact—an important criteria in the design of aircraft, helicopters and other VTOL vehicles. Possible future applications for a more powerful, ultrasonic doppler system might be airborne descent devices for aircraft and soft landing systems for space vehicles.

The Air Force and the Navy have long sought a device for accurate measurement of vertical velocity at touchdown. Methods devised to measure this parameter include mechanical tracking arms, photographic techniques, electronic and electro-optical systems. Some of the systems has varied, with perhaps the most accurate systems involving ground installations.

The Gellert Industries airborne ultrasonic Doppler system measures velocity of the last 15 in. of vertical descent so actual contact and on any subsequent rebounds. Vertical velocity (0 to 20 ft/sec) is recorded on an airborne recorder.

Three ultrasonic transducer units mounted on the nose and main landing gear bounce a frequency-modulated signal off the runway reflecting surface and receive the return pulse. The doppler shift resulting in the distance between transmitter and the reflecting surface changes is a function of closure rate. The detected frequency is then locked to produce a d.c. voltage proportional to the detected frequency.

The transmitter operates on 58 kc. crystal. The 58 kc. unmodulated signal tied to the acoustic transducer element which consists of a cluster of flexor elements tuned to approximately 50 kc. The single channel receiving unit obtains a second accuracy of 110 db for a transmit-receive path of 32 in. The output of the receiver is coded with a 7544 frequency and provides to output frequency of 6 kc. at zero doppler. The received signal will vary from 50 to 55 kc. as the vertical velocity changes from 0 to 20 ft/sec.

An impedance effect on some velocity measurements a low pressure control. This is afforded by a velocity conversion channel which sends a modulated pulse across a precise 6000 distance to a receiving transducer. The result is degraded as that pulse width is determined by the impedance loss (approximately 100 microseconds). This is



...requires

Realistic Simulation

REDSTONE . . . ATLAS . . .
SERGEANT . . . AND NIKE
missile ground crews
get their EXPERIENCE
through continuous
practice on training
equipment developed
by America's most
EXPERIENCED designer
and manufacturer of
missile training devices
and simulation systems.



AIRCRAFT ARMAMENTS, INC.
COCKEYSVILLE, MARYLAND



Predict the sun's effect on space vehicles...in your lab!

B&L Optical/Electronic/Mechanical Capabilities
Bring the Sun Into the Laboratory

Interplanetary flight will expose our astronauts to direct radiation from the sun, and to direct and reflected radiation from the earth and clouds. To find the effects of this solar radiation on man and vehicles in outer space, Bausch & Lomb has designed a unique Sun Simulator System.

A special combination of lamps, filters, optical system and programmed control accurately simulates the intensity and distribution of those radiation wavelengths duplicating the conditions that exist in actual flight.

The same B&L skills are ready to help on your project. Write us for full details. Bausch & Lomb Incorporated,

Military Products Division,
82319 Bausch Street,
Rochester 2, New York.

BAUSCH & LOMB

said, to feed correction currents in each receiver channel, thus providing temperature control.

Atmospheric conditions which could appear to affect the accuracy of the doppler doppler include a boundary heat layer just the ground and wind conditions. Galton says that accurate tests performed on a seven Angstrom diode centers, black asphalt and metal rail radars indicate less than 100 ft temperature differential measurement over the last 1 in. of travel. Then, with the transducer mounted 15 in. from the bottom of the wheel, the error is reduced over 1/5 of the total path. This is computed to be 0.1% measurement.

The effect of wind conditions on some vehicles is negated by mounting the sending and receiving transducers adjacent to one another so that the forward and return paths are acted upon equally.

Aircraft forward velocity may vary from 0 to 400 fpm as beam width on the ground is 14-in. wide to ensure reception by the receiving transducer. At 400 fpm forward velocity (273 mph) an aircraft will travel about 2.4 ft in the time required for the sound to make a 6 ft round trip.

The Galton rate-of-descent indicator system consists of an independent unit, a power supply unit, a doppler transmitter velocity, correction unit, display receiver and three transducer units. The power supply is a transistorized unit which will operate from a 255 dc or 115v, 60-cps source. The display transducer closely corrects and contains two silicon semiconductor transducer subsystems. The doppler receiver consists of three separate units in chassis and is electronically similar to the doppler transmitter unit.

Each of the three transducer units consists of a transmitting and receiving transducer for measuring landing velocities.

Shatterproof Wheels Prove Out on Hustler

It Works, Tex.—Shatterproof auxiliary wheels have been successfully tested on the General Dynamics/FB-Worth B-76A Hustler supersonic bomber at Edwards AFB, Calif. The new aluminum alloy wheels, 15 in. in diameter, are mounted between each pair of B-76A B-55 tires.

In the tests, two were blown in, going spikes into them after the B-55 had rolled 1,500 ft and was at full power. After the intentional blowout, the B-55 continued to accelerate down the runway for 10,000 ft, taking off at 275 mph and then landing at 150 mph rolling on the shatterproof auxiliary wheels for 11,000 ft. The new alloy forgable wheels were made by Goodwin-Tier & Rubber Co., Alameda,



RAMJET-POWERED VG-52 technological sounding rocket is produced by Aakros, Greenwood & Co. Left photo shows rocket boosters.

Light Rocket Features Solid-Fuel Ramjet

By Erwin J. Bellus

Dallas, Tex.—Solid-fueled ramjet powered technological sounding rocket has been tested successfully in its design at 300,000 ft.

The peak, capable of carrying a

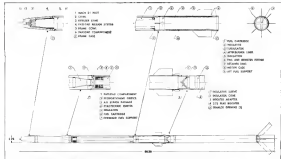
MISSILE ENGINEERING



scientific payload of up to 2.5 lb, was designed and built by Anderson, Greenwood & Co., Houston, Tex. The company hopes it will find applications in research groups and a continental technological rocket network for path

on a low cost test. Because the vehicle is built around readily available rocket stages, cost of complete units, even payloads, is estimated at \$400 each in quantity, based on a production rate of 100 per month.

Bausch, the AG-32 Net Jet is a



NET JET ramjet design details. Solid-fuel gives a supersonic and supersonic-thrusting after space-control change.

CLEMCO
AERO PRODUCTS, INC.



**NOW SERVING THE
LEADING NAMES
IN THE
HELICOPTER
INDUSTRY**



**ROTOR BLADE
DAMPER**

The Clemco Aero Products Rotor Blade Damper is designed to perform the precise and severe function of eliminating ground resonance of helicopters using articulated blades.

The damper is designed to continuously replenish and bleed itself when operated in a centrifugal force field. Any desired damping force versus velocity characteristics can be programmed into the dynamically stable, pressure operated stroke valve, and is independent of temperature.

Seal life and low friction are accomplished by unlatching the piston rod "O" ring seals. The piston seal is the proven long life low friction triple piston ring oil. Trunnion bushings and rod end ball joints are "Fabrod" requiring no lubrication and ensuring a long trouble free life. The damper may be used as a positive blade stop in both directions, and snubbing can be incorporated.

Fatigue life has been a prime consideration in the design of these units. Operating life in excess of 1000 hours or 30 million cycles is achieved without overhaul or servicing.

The world's leading producer of precision hydraulic cylinders and components. Designed and manufactured in accordance with ISO 9001. ISO 9002. ISO 9003. ISO 9004. ISO 9005. ISO 9006. ISO 9007. ISO 9008. ISO 9009. ISO 9010. ISO 9011. ISO 9012. ISO 9013. ISO 9014. ISO 9015. ISO 9016. ISO 9017. ISO 9018. ISO 9019. ISO 9020. ISO 9021. ISO 9022. ISO 9023. ISO 9024. ISO 9025. ISO 9026. ISO 9027. ISO 9028. ISO 9029. ISO 9030. ISO 9031. ISO 9032. ISO 9033. ISO 9034. ISO 9035. ISO 9036. ISO 9037. ISO 9038. ISO 9039. ISO 9040. ISO 9041. ISO 9042. ISO 9043. ISO 9044. ISO 9045. ISO 9046. ISO 9047. ISO 9048. ISO 9049. ISO 9050. ISO 9051. ISO 9052. ISO 9053. ISO 9054. ISO 9055. ISO 9056. ISO 9057. ISO 9058. ISO 9059. ISO 9060. ISO 9061. ISO 9062. ISO 9063. ISO 9064. ISO 9065. ISO 9066. ISO 9067. ISO 9068. ISO 9069. ISO 9070. ISO 9071. ISO 9072. ISO 9073. ISO 9074. ISO 9075. ISO 9076. ISO 9077. ISO 9078. ISO 9079. ISO 9080. ISO 9081. ISO 9082. ISO 9083. ISO 9084. ISO 9085. ISO 9086. ISO 9087. ISO 9088. ISO 9089. ISO 9090. ISO 9091. ISO 9092. ISO 9093. ISO 9094. ISO 9095. ISO 9096. ISO 9097. ISO 9098. ISO 9099. ISO 9100. ISO 9101. ISO 9102. ISO 9103. ISO 9104. ISO 9105. ISO 9106. ISO 9107. ISO 9108. ISO 9109. ISO 9110. ISO 9111. ISO 9112. ISO 9113. ISO 9114. ISO 9115. ISO 9116. ISO 9117. ISO 9118. ISO 9119. ISO 9120. ISO 9121. ISO 9122. ISO 9123. ISO 9124. ISO 9125. ISO 9126. ISO 9127. ISO 9128. ISO 9129. ISO 9130. ISO 9131. ISO 9132. ISO 9133. ISO 9134. ISO 9135. ISO 9136. ISO 9137. ISO 9138. ISO 9139. ISO 9140. ISO 9141. ISO 9142. ISO 9143. ISO 9144. ISO 9145. ISO 9146. ISO 9147. ISO 9148. ISO 9149. ISO 9150. ISO 9151. ISO 9152. ISO 9153. ISO 9154. ISO 9155. ISO 9156. ISO 9157. ISO 9158. ISO 9159. ISO 9160. ISO 9161. ISO 9162. ISO 9163. ISO 9164. ISO 9165. ISO 9166. ISO 9167. ISO 9168. ISO 9169. ISO 9170. ISO 9171. ISO 9172. ISO 9173. ISO 9174. ISO 9175. ISO 9176. ISO 9177. ISO 9178. ISO 9179. ISO 9180. ISO 9181. ISO 9182. ISO 9183. ISO 9184. ISO 9185. ISO 9186. ISO 9187. ISO 9188. ISO 9189. ISO 9190. ISO 9191. ISO 9192. ISO 9193. ISO 9194. ISO 9195. ISO 9196. ISO 9197. ISO 9198. ISO 9199. ISO 9200. ISO 9201. ISO 9202. ISO 9203. ISO 9204. ISO 9205. ISO 9206. ISO 9207. ISO 9208. ISO 9209. ISO 9210. ISO 9211. ISO 9212. ISO 9213. ISO 9214. ISO 9215. ISO 9216. ISO 9217. ISO 9218. ISO 9219. ISO 9220. ISO 9221. ISO 9222. ISO 9223. ISO 9224. ISO 9225. ISO 9226. ISO 9227. ISO 9228. ISO 9229. ISO 9230. ISO 9231. ISO 9232. ISO 9233. ISO 9234. ISO 9235. ISO 9236. ISO 9237. ISO 9238. ISO 9239. ISO 9240. ISO 9241. ISO 9242. ISO 9243. ISO 9244. ISO 9245. ISO 9246. ISO 9247. ISO 9248. ISO 9249. ISO 9250. ISO 9251. ISO 9252. ISO 9253. ISO 9254. ISO 9255. ISO 9256. ISO 9257. ISO 9258. ISO 9259. ISO 9260. ISO 9261. ISO 9262. ISO 9263. ISO 9264. ISO 9265. ISO 9266. ISO 9267. ISO 9268. ISO 9269. ISO 9270. ISO 9271. ISO 9272. ISO 9273. ISO 9274. ISO 9275. ISO 9276. ISO 9277. ISO 9278. ISO 9279. ISO 9280. ISO 9281. ISO 9282. ISO 9283. ISO 9284. ISO 9285. ISO 9286. ISO 9287. ISO 9288. ISO 9289. ISO 9290. ISO 9291. ISO 9292. ISO 9293. ISO 9294. ISO 9295. ISO 9296. ISO 9297. ISO 9298. ISO 9299. ISO 9300. ISO 9301. ISO 9302. ISO 9303. ISO 9304. ISO 9305. ISO 9306. ISO 9307. ISO 9308. ISO 9309. ISO 9310. ISO 9311. ISO 9312. ISO 9313. ISO 9314. ISO 9315. ISO 9316. ISO 9317. ISO 9318. ISO 9319. ISO 9320. ISO 9321. ISO 9322. ISO 9323. ISO 9324. ISO 9325. ISO 9326. ISO 9327. ISO 9328. ISO 9329. ISO 9330. ISO 9331. ISO 9332. ISO 9333. ISO 9334. ISO 9335. ISO 9336. ISO 9337. ISO 9338. ISO 9339. ISO 9340. ISO 9341. ISO 9342. ISO 9343. ISO 9344. ISO 9345. ISO 9346. ISO 9347. ISO 9348. ISO 9349. ISO 9350. ISO 9351. ISO 9352. ISO 9353. ISO 9354. ISO 9355. ISO 9356. ISO 9357. ISO 9358. ISO 9359. ISO 9360. ISO 9361. ISO 9362. ISO 9363. ISO 9364. ISO 9365. ISO 9366. ISO 9367. ISO 9368. ISO 9369. ISO 9370. ISO 9371. ISO 9372. ISO 9373. ISO 9374. ISO 9375. ISO 9376. ISO 9377. ISO 9378. ISO 9379. ISO 9380. ISO 9381. ISO 9382. ISO 9383. ISO 9384. ISO 9385. ISO 9386. ISO 9387. ISO 9388. ISO 9389. ISO 9390. ISO 9391. ISO 9392. ISO 9393. ISO 9394. ISO 9395. ISO 9396. ISO 9397. ISO 9398. ISO 9399. ISO 9400. ISO 9401. ISO 9402. ISO 9403. ISO 9404. ISO 9405. ISO 9406. ISO 9407. ISO 9408. ISO 9409. ISO 9410. ISO 9411. ISO 9412. ISO 9413. ISO 9414. ISO 9415. ISO 9416. ISO 9417. ISO 9418. ISO 9419. ISO 9420. ISO 9421. ISO 9422. ISO 9423. ISO 9424. ISO 9425. ISO 9426. ISO 9427. ISO 9428. ISO 9429. ISO 9430. ISO 9431. ISO 9432. ISO 9433. ISO 9434. ISO 9435. ISO 9436. ISO 9437. ISO 9438. ISO 9439. ISO 9440. ISO 9441. ISO 9442. ISO 9443. ISO 9444. ISO 9445. ISO 9446. ISO 9447. ISO 9448. ISO 9449. ISO 9450. ISO 9451. ISO 9452. ISO 9453. ISO 9454. ISO 9455. ISO 9456. ISO 9457. ISO 9458. ISO 9459. ISO 9460. ISO 9461. ISO 9462. ISO 9463. ISO 9464. ISO 9465. ISO 9466. ISO 9467. ISO 9468. ISO 9469. ISO 9470. ISO 9471. ISO 9472. ISO 9473. ISO 9474. ISO 9475. ISO 9476. ISO 9477. ISO 9478. ISO 9479. ISO 9480. ISO 9481. ISO 9482. ISO 9483. ISO 9484. ISO 9485. ISO 9486. ISO 9487. ISO 9488. ISO 9489. ISO 9490. ISO 9491. ISO 9492. ISO 9493. ISO 9494. ISO 9495. ISO 9496. ISO 9497. ISO 9498. ISO 9499. ISO 9500. ISO 9501. ISO 9502. ISO 9503. ISO 9504. ISO 9505. ISO 9506. ISO 9507. ISO 9508. ISO 9509. ISO 9510. ISO 9511. ISO 9512. ISO 9513. ISO 9514. ISO 9515. ISO 9516. ISO 9517. ISO 9518. ISO 9519. ISO 9520. ISO 9521. ISO 9522. ISO 9523. ISO 9524. ISO 9525. ISO 9526. ISO 9527. ISO 9528. ISO 9529. ISO 9530. ISO 9531. ISO 9532. ISO 9533. ISO 9534. ISO 9535. ISO 9536. ISO 9537. ISO 9538. ISO 9539. ISO 9540. ISO 9541. ISO 9542. ISO 9543. ISO 9544. ISO 9545. ISO 9546. ISO 9547. ISO 9548. ISO 9549. ISO 9550. ISO 9551. ISO 9552. ISO 9553. ISO 9554. ISO 9555. ISO 9556. ISO 9557. ISO 9558. ISO 9559. ISO 9560. ISO 9561. ISO 9562. ISO 9563. ISO 9564. ISO 9565. ISO 9566. ISO 9567. ISO 9568. ISO 9569. ISO 9570. ISO 9571. ISO 9572. ISO 9573. ISO 9574. ISO 9575. ISO 9576. ISO 9577. ISO 9578. ISO 9579. ISO 9580. ISO 9581. ISO 9582. ISO 9583. ISO 9584. ISO 9585. ISO 9586. ISO 9587. ISO 9588. ISO 9589. ISO 9590. ISO 9591. ISO 9592. ISO 9593. ISO 9594. ISO 9595. ISO 9596. ISO 9597. ISO 9598. ISO 9599. ISO 9600. ISO 9601. ISO 9602. ISO 9603. ISO 9604. ISO 9605. ISO 9606. ISO 9607. ISO 9608. ISO 9609. ISO 9610. ISO 9611. ISO 9612. ISO 9613. ISO 9614. ISO 9615. ISO 9616. ISO 9617. ISO 9618. ISO 9619. ISO 9620. ISO 9621. ISO 9622. ISO 9623. ISO 9624. ISO 9625. ISO 9626. ISO 9627. ISO 9628. ISO 9629. ISO 9630. ISO 9631. ISO 9632. ISO 9633. ISO 9634. ISO 9635. ISO 9636. ISO 9637. ISO 9638. ISO 9639. ISO 9640. ISO 9641. ISO 9642. ISO 9643. ISO 9644. ISO 9645. ISO 9646. ISO 9647. ISO 9648. ISO 9649. ISO 9650. ISO 9651. ISO 9652. ISO 9653. ISO 9654. ISO 9655. ISO 9656. ISO 9657. ISO 9658. ISO 9659. ISO 9660. ISO 9661. ISO 9662. ISO 9663. ISO 9664. ISO 9665. ISO 9666. ISO 9667. ISO 9668. ISO 9669. ISO 9670. ISO 9671. ISO 9672. ISO 9673. ISO 9674. ISO 9675. ISO 9676. ISO 9677. ISO 9678. ISO 9679. ISO 9680. ISO 9681. ISO 9682. ISO 9683. ISO 9684. ISO 9685. ISO 9686. ISO 9687. ISO 9688. ISO 9689. ISO 9690. ISO 9691. ISO 9692. ISO 9693. ISO 9694. ISO 9695. ISO 9696. ISO 9697. ISO 9698. ISO 9699. ISO 9700. ISO 9701. ISO 9702. ISO 9703. ISO 9704. ISO 9705. ISO 9706. ISO 9707. ISO 9708. ISO 9709. ISO 9710. ISO 9711. ISO 9712. ISO 9713. ISO 9714. ISO 9715. ISO 9716. ISO 9717. ISO 9718. ISO 9719. ISO 9720. ISO 9721. ISO 9722. ISO 9723. ISO 9724. ISO 9725. ISO 9726. ISO 9727. ISO 9728. ISO 9729. ISO 9730. ISO 9731. ISO 9732. ISO 9733. ISO 9734. ISO 9735. ISO 9736. ISO 9737. ISO 9738. ISO 9739. ISO 9740. ISO 9741. ISO 9742. ISO 9743. ISO 9744. ISO 9745. ISO 9746. ISO 9747. ISO 9748. ISO 9749. ISO 9750. ISO 9751. ISO 9752. ISO 9753. ISO 9754. ISO 9755. ISO 9756. ISO 9757. ISO 9758. ISO 9759. ISO 9760. ISO 9761. ISO 9762. ISO 9763. ISO 9764. ISO 9765. ISO 9766. ISO 9767. ISO 9768. ISO 9769. ISO 9770. ISO 9771. ISO 9772. ISO 9773. ISO 9774. ISO 9775. ISO 9776. ISO 9777. ISO 9778. ISO 9779. ISO 9780. ISO 9781. ISO 9782. ISO 9783. ISO 9784. ISO 9785. ISO 9786. ISO 9787. ISO 9788. ISO 9789. ISO 9790. ISO 9791. ISO 9792. ISO 9793. ISO 9794. ISO 9795. ISO 9796. ISO 9797. ISO 9798. ISO 9799. ISO 9800. ISO 9801. ISO 9802. ISO 9803. ISO 9804. ISO 9805. ISO 9806. ISO 9807. ISO 9808. ISO 9809. ISO 9810. ISO 9811. ISO 9812. ISO 9813. ISO 9814. ISO 9815. ISO 9816. ISO 9817. ISO 9818. ISO 9819. ISO 9820. ISO 9821. ISO 9822. ISO 9823. ISO 9824. ISO 9825. ISO 9826. ISO 9827. ISO 9828. ISO 9829. ISO 9830. ISO 9831. ISO 9832. ISO 9833. ISO 9834. ISO 9835. ISO 9836. ISO 9837. ISO 9838. ISO 9839. ISO 9840. ISO 9841. ISO 9842. ISO 9843. ISO 9844. ISO 9845. ISO 9846. ISO 9847. ISO 9848. ISO 9849. ISO 9850. ISO 9851. ISO 9852. ISO 9853. ISO 9854. ISO 9855. ISO 9856. ISO 9857. ISO 9858. ISO 9859. ISO 9860. ISO 9861. ISO 9862. ISO 9863. ISO 9864. ISO 9865. ISO 9866. ISO 9867. ISO 9868. ISO 9869. ISO 9870. ISO 9871. ISO 9872. ISO 9873. ISO 9874. ISO 9875. ISO 9876. ISO 9877. ISO 9878. ISO 9879. ISO 9880. ISO 9881. ISO 9882. ISO 9883. ISO 9884. ISO 9885. ISO 9886. ISO 9887. ISO 9888. ISO 9889. ISO 9890. ISO 9891. ISO 9892. ISO 9893. ISO 9894. ISO 9895. ISO 9896. ISO 9897. ISO 9898. ISO 9899. ISO 9900. ISO 9901. ISO 9902. ISO 9903. ISO 9904. ISO 9905. ISO 9906. ISO 9907. ISO 9908. ISO 9909. ISO 9910. ISO 9911. ISO 9912. ISO 9913. ISO 9914. ISO 9915. ISO 9916. ISO 9917. ISO 9918. ISO 9919. ISO 9920. ISO 9921. ISO 9922. ISO 9923. ISO 9924. ISO 9925. ISO 9926. ISO 9927. ISO 9928. ISO 9929. ISO 9930. ISO 9931. ISO 9932. ISO 9933. ISO 9934. ISO 9935. ISO 9936. ISO 9937. ISO 9938. ISO 9939. ISO 9940. ISO 9941. ISO 9942. ISO 9943. ISO 9944. ISO 9945. ISO 9946. ISO 9947. ISO 9948. ISO 9949. ISO 9950. ISO 9951. ISO 9952. ISO 9953. ISO 9954. ISO 9955. ISO 9956. ISO 9957. ISO 9958. ISO 9959. ISO 9960. ISO 9961. ISO 9962. ISO 9963. ISO 9964. ISO 9965. ISO 9966. ISO 9967. ISO 9968. ISO 9969. ISO 9970. ISO 9971. ISO 9972. ISO 9973. ISO 9974. ISO 9975. ISO 9976. ISO 9977. ISO 9978. ISO 9979. ISO 9980. ISO 9981. ISO 9982. ISO 9983. ISO 9984. ISO 9985. ISO 9986. ISO 9987. ISO 9988. ISO 9989. ISO 9990. ISO 9991. ISO 9992. ISO 9993. ISO 9994. ISO 9995. ISO 9996. ISO 9997. ISO 9998. ISO 9999.

Tee-Loc® ROTOR BLADE FOLO LOCKING MECHANISM

Tee-LOC locking cylinders are now available for folding and locking helicopter rotor blades. Actuation and positive mechanical locking in the folded position is provided in the Tee-LOC design.



CLEMCO AERO PRODUCTS, INC.

1680 East Main Street, Corona, California

A Division of STRUTWORKS INDUSTRIES, INC.

21-lb. rotor, 96.5 in. long and 2.75 in. in diameter, the latter being the direct cost of a standard folding five-blade rotor (F5AR) produced in large quantities for tactical air-to-air use. The rotor produces 710 ft thrust for 1.6 sec which accelerates the second stage to 2,000 lbs/sec velocity necessary for target engine operation. After separation, the target system or shroud increases velocity through the denser portion of the earth's atmosphere until fuel is expended after some 30 sec. at an altitude of 70,000 ft. After engine burnout the vehicle starts the rest of the way to design apogee.

Propellant Grain

The solid fuel grain of the Mat Jet is a regressive and regressive-symmetric also, open-ended shape with a combustion temperature of approx 4,750 deg. Sec. it does not contain an oxidizer, the fire hazard is minimized; carbon must be sequestered by a high heat source such as a regressive flame.

Operationally, the rocket booster provides acceleration beyond the target stage's Mach 1.6 minimum speed. Air pressure over the 31-deg. cone and is is operationally diffused to Mach 1 at the cone's inlet lip. All internal diffusion is subsonic and takes place in the ring passage around the perforated "inlet" and adjacent to the outlet slot. The pressure allowed determines the mass flow pressure at which fuel combustion is this place.

Compressed air then passes a pre-purifying orifice, which removes 95% of the air drawn in passage outside the solid fuel sleeve and 15% through the fuel rotor passage. The air charge is contact with the fuel burn with it to produce a fuel-rich gas whose composition is controlled as the regressive, heated air pass the fuel rich hot gas in an afterburner section. Combustion is aided by a moving device called a Turbulator. Burned gases are forced through the exit nozzle by the pressure differential between combustion chamber and the ambient atmosphere. This expander further increases air velocity and thrust energy.

Regime's Regime

The spiral shape of the solid fuel target is in retrograde stages a high speed. The currently achieved rate of 700 ft per sec per pound of fuel is in excess of being depicted in 1,300 ft. Anderson's Groundwater on gases below, compressed tank upper, which 136 to 240 for solid rocket, thus providing greater mass per pound of fuel than a conventional solid rocket fuel cell.

No engineers note that since the goal is to air breakout, it is a more or less constructed as capable of high-alti-

A compelling challenge—to assist the orthopedically handicapped in performing the simple and rewarding manual functions that lead to richer, more useful lives.

Working with orthotic and prosthetic specialists in hospitals and medical schools, Fairchild Research and Development personnel have done considerable experimentation in this field with strain gauges, special assemblies and Micrologic components. Using these elements for sensing, logic, control, and feedback building blocks, it is thought that human mechanisms for commanding and verifying body motions may be closely approximated.

Problems are myriad. The challenge great. The rewards immeasurable. We believe it is a worthy goal to unlock doors in the Human Horizons. If you would like to share in a challenge such as this, and yours is a relevant background, we would like very much to hear from you.

HUMAN HORIZONS



FAIRCHILD

SEMICONDUCTOR

SEMICONDUCTOR DIVISION, FAIRCHILD, INC., SEMICONDUCTOR
A DIVISION OF FAIRCHILD CORP., 2000 FAIRCHILD DRIVE, MILWAUKEE, WISCONSIN 53212



ALCOA CAPABILITY AT WORK...
tough, tight tolerance, thin wall,
premium castings by the 10's or 1,000's



ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

cores below 200 psi. Solid propellant rocket chamber burns extremely range from 500 psi. to 1,200 psi. Lower chamber pressures will enable designers to use lighter weight cases to get higher propellant mass ratios and better performance.

The company has fired more than 30 test motors, each containing 50 lb. of Polycarbonate R with subaluminized slag of aluminum powder. Polycarbonate R is called "a polycarbonate-type liquid polymer of butadiene and styrene and combined with aluminum casting agents." The test motors were qualified for a temperature range between -100F and 150F.

Soon, Grand Central plans to test for a pair of 1-ft diameter, segmented motor cases containing more than 5,000 lb. of the new propellant and motor per loaded with about 8,000 lb. of propellant. They will be operated at widely differing temperatures. The new propellant is used with a special liner qualified between -110F and 750F.

Sud Develops Family Of Sounding Probes

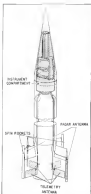
Paris-Sud Airframe is developing a series of inexpensive high-altitude sounding rockets designed eventually to lift 660 lb. payload up to altitude of 130 mi.

Sud already has tested two early types with complete success. Rockets are being built by Sud for the Centre National d'Etudes des Télécommunications, research branch at the French Post Office.

The series of six different types was designed to supply government scientists with a cheap yet reliable sounding rocket. All six rockets are powered by solid fuel.

The six rockets break down into two groups. First group includes the following four rockets:

- **Beller.** Single stage, Mach 4.8 motor designed to lift 40 lb. payload to 100 mi altitude. Costing about \$6,000 per unit, two Bellers were fired in the Sahara late in May.
- **Creston.** Beller is upper stage fitted with first stage booster, Mach 5.5 motor designed to lift 40 lb. payload to 130-mi altitude. Costing about \$30,000, two Crestons were fired in the Sahara late in May.
- **Dynow.** Again, Beller is used as upper stage. To this is fitted a booster stage delivering some seven tons of thrust. Rocket reaches Mach 7.5 and carries 40-lb payload to 250-mi altitude. Design work are scheduled to be completed by spring, 1962.
- **Pegase.** Beller upper stage fitted with two stage booster. Pegase, reaching Mach 12.5 speeds, will carry 60 lb. payload up to 320 mi altitude.



STANDARD LAYOUT of the Beller rocket family shows solid instrument compartment bolted with thrust unit by wire along side of rocket case. Spin rockets fire immediately after lift-off, then disengage.

load up to 620 mi. altitude. Pegase is expected to be fired in spring, 1962.

All four of these sounding rockets are wingless. Small jets fitted into the tail surfaces spin the rockets immediately upon launching and then disengage.

Ground control is limited to destruction. Tracking is achieved by radar again mounted and synchronized by special units fitted into the rocket's tail unit.

Four antennas—in addition to the tracking edge of the tail surfaces. These handle telemetry, downlink.

In addition to these four sounding rockets, all contained inside the Beller, Sud is developing two larger rockets for high-altitude probes. These rockets, slated to be ready for launching next spring are:

- **Agile.** Single stage rocket containing 1,200 lb. booster charge will lift 220 lb. payload to 130 mi altitude or 660 lb. payload to 150 mi.
- **Endau.** Same as Agile except booster is hooked on at first stage. Endau will lift 220 lb. payload to 200-mi altitude or 660 lb. payload to 180 mi. height.



**TOUGH,
TIGHT TOLERANCE,
THIN WALL,
PREMIUM CASTINGS
BY THE 10's
OR 1,000's**

The picture shows some exotic Alcoa premium castings. We call them premium because each is a sophisticated example of high strength, intricate configuration, dimensional accuracy, smooth finish—or all four.

Take the casting at the extreme right. Its shape is for lightening. The two cores are independent of one another. Divides at 0.001. Walls are 0.001. Tolerances on the interior passages is ±0.000. Surface finish is 70 micro.

PROTOTYPES OR FULL PRODUCTION RUNS

Alcoa is frequently the only company that can handle aluminum premium castings like these. And we see them in our inventory you need, from one to several thousand. Alcoa's Unique Laboratory Facility has already produced well over a hundred different premium castings, in quantities ranging from six pieces to several hundred. When small runs become large runs, the total bar from laboratory to factory is easily accomplished.

Castings, forgings, impellers, extrusions—Alcoa has more experience with them than any other aluminum producer in the world. More money and people assigned to R&D, more production tools and techniques in more plants. How can you use this capability? Write: Alcoa Company of America, 1875-L Alcoa Bldg., Pittsburgh 18, Pa.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

AVIATION WEEK and Space Technology's ever-expanding list of marketing services has a new addition as a convenience to aerospace industry manufacturers. We have engaged the services of Frost & Sullivan Inc., defense marketing specialists who have devised a unique data processing program for assembling and tabulating defense contract award information.

announces... a new marketing service

With this new service, AVIATION WEEK will be able to identify on a quarterly basis the total prime defense contract dollars awarded by the various agencies of the Defense Department and subcontracts awarded by prime contractors in ITS product categories. Starting with the 4th fiscal quarter of 1968, reports will be available on an individual request basis.

This new exclusive service will enable aerospace marketing executives to determine the importance of various segments of the industry and to discover which Defense Department agencies are most important in a particular product/system category.

AVIATION WEEK is pleased to add this unique marketing service to the services it now renders to aerospace industry manufacturers on their sales and marketing problems.

OTHER AVIATION WEEK MARKETING SERVICES:

Monthly Market Letter
Industry Market Reports
Annual Industry Reports
Executive Research Reports

Special Survey Reports
Product Recognition Studies
Company Recognition Studies
Personnel Marketing Assistance

FROST & SULLIVAN INC.

Frost & Sullivan are defense marketing specialists who have spent over two years developing and proving a method to gather and analyze information on defense contract awards. Statistical computations show their data processing system with a capability of identifying over 90% of all prime defense contract awards over \$50,000 and a significantly high percentage of subcontracts awarded by prime contractors.

Unlike other contract reporting systems which simply report an individual contract awarded, the Frost & Sullivan service has tremendous flexibility because all information is computer processed. Presumably any combination of summary information is readily available as a special request basis from Frost & Sullivan. For example the regular quarterly reporting service includes a product and company series.

The product series shows which companies received contracts in ITS product/system categories. The company series analyzes individual companies by contracts awarded.

Naturally, in order not to conflict with the aims of Frost & Sullivan, AVIATION WEEK is restricted in the amount of information it can provide. Companies interested in further information on Frost & Sullivan services, are invited to contact them direct.

Frost & Sullivan Inc., 270 Broadway, New York 26, N. Y.

Aviation Week
... Space Technology

A McGraw-Hill Publication
220 West 43rd Street, New York 26, N. Y.



Titan II unit shown in Hamilton Standard White Room for assembly and checkout. Unit is designed to pump and meter propellants to first and second missile stages at rates up to 100 gpm and pressures to 150 psig.

White room for the Titan II propellant transfer system

Development and production of equipment for handling extremely volatile missile fuels—like the propellant transfer unit for The Marine Company's Titan II—demands a contamination-free environment, controlled to within 0.3 micron. Hamilton Standard's new White Room, especially designed for handling missile fuel handling systems, even surpasses the exacting requirements of a hospital operating room. It provides 900 square feet of ultra-modern assembly and testing equipment. Detailed construction care and strict control procedures will maintain immaculate conditions...

... always. Building a propellant transfer unit for the Air Force Titan II missile program is just one of several recent GSE projects in which extreme cleanliness has been a major consideration. This package unit is air-sealed, electrically powered, manually controlled (with auto-

matic control), and capable of pumping either fuel or oxidizer. Performance is measured by its ability to absolutely contain toxic fumes and vapors. To meet these requirements, Hamilton Standard developed important new concepts in sealing and system reliability.

The White Room's capabilities work hand in hand with other key controls to provide manufacturing quality, functional reliability, low system cost, and on-time delivery of all Hamilton Standard Ground Support Equipment.

For the solution to your missile fuel handling problems... or any GSE assignment from missile development to complete weapon support systems, please: Manager, Ground Support Equipment Department, Hamilton Standard, Windsor Locks, Connecticut; or write for illustrated brochure.

UNITED AIRCRAFT CORPORATION

HAMILTON STANDARD DIVISION

GROUND SUPPORT EQUIPMENT



Drag-Increasing Device Has Dyna-Soar, X-15 Application

North American F-105 Super Sabre fighter has been modified by the Air Force Atmospheric Systems Division with devices to increase drag in order that steep angle landings can be made to test the possibility of eliminating long runways needed by the improved landings of the X-15 and the Dyna-Soar boost-glide vehicle. Afterburners and drag chute have been removed and replaced with a Ramjet nozzles and the variable drag hook of 12 sq ft has been replaced with one of 35 sq ft. Landing profile includes steepening the thrust vector at 4,000 ft, making a steep angle approach and landing at 210 mph instead of the usual 110 mph. Tests are expected to reveal whether manual or autopilot control will be best for steep landings.

USAF Contracts

Following is a list of unclassified contracts for \$25,000 and over as released by U.S. Air Force contracting office:

HEATING, VENTILATION, AND AIR CONDITIONING. B2042 Air Mfg. TRAIL AREA USAF Collins AFB N.Y. Collins Radio Co., Cedar Rapids, Iowa. WFOB DA portable space heater. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

D. E. REMONDY CO., CHICAGO, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

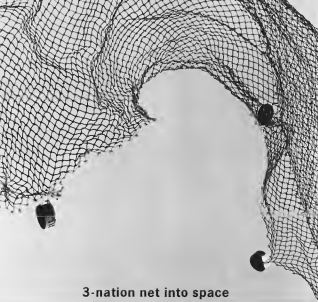
COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.

COASTAL COMMERCIAL CORP., QUINCY, ILLINOIS. Various items. MIL-C-11100 and MIL-C-11101. Contract AF 33(01)17714-101-101.



3-nation net into space

Guatemala, Calif., Woomera, Australia; Krugersburg, South Africa.

Three different parts of the world thousands of miles from each other. Yet drawn together in a new and unique communications net: the Deep Space Instrumentation Facility.

DSIF is under the technical direction of Cal Tech's Jet Propulsion Laboratory for the National Aeronautics and Space Administration. Surface and run by the host countries, the tracking stations will have 25-foot-diameter antennas, capable of transmitting and receiving. These giant, revolving steel and aluminum antennas are able to send and receive signals hundreds of millions of miles in and from space.

It was at Goldstone that JPL beamed signals off the planet Venus—15-million miles away. Two two-month experiments gave us valuable data about the distance and surface of Venus and helped maintain the United States in the leader in planetary radar astronomy.

Communicating with deep space probes is just one function of the three stations of DSIF. Their primary job is tracking all the spacecraft designed by JPL, to flyby, orbit, and land on the moon and planets.

Because the network provides 360° coverage around the earth, one of the three will always be in contact with each distant spacecraft in flight and after it arrives.

DSIF is an essential participant in the many space projects at JPL. Ranger, Surveyor, Mariner. Some of these spacecraft are unmanned. Others are JPL. Both kinds. All will bring new techniques, new knowledge of our planets and the topics unknown beyond, and a still greater understanding of our own small world.

To carry on these vital projects, we need top scientists and engineers of many different disciplines. We need people who love their work, who want to know, and want to participate in the exploration of other worlds. If you believe you're qualified, then come explain with us. Write today.

JET PROPULSION LABORATORY

4812 Oak Grove Drive, Pasadena, California

Specialty facilities include technology for the National Aeronautics and Space Administration



NEEDS SENIOR RESEARCH ENGINEERS AND SCIENTISTS

• To study space communication: show orbits for efficiency, error correction, security, reliability, guidance, and control. Must have Ph.D. with one year's experience or Master's Degree with three years' experience in discrete mathematics and applications to information theory, coding problems, and statistical communications theory.

• To study the various phases of space flight operations including tracking and orbit determination. Must have M.S. in mathematics or related field and thorough knowledge of classical physics, plus three years' experience in data analysis, statistics, trigonometry, etc.

• To design, develop and evaluate antennas and/or systems. Must have B.S. Degree in electrical engineering and two to five years' experience in navigation, transmitter assembly, power systems, receiving machines, and radio antenna design.

Other opportunities exist for electronic engineers and physicists in many areas at JPL, which has been assigned by NASA the responsibility for the nation's Lunar, Planetary, and Interplanetary unmanned exploration programs.

Send complete qualifications resume now for immediate consideration.

All qualified applicants will receive consideration for employment without regard to race, creed or national origin.

If S. citizenship or current security clearance required.

JET PROPULSION LABORATORY

California Institute of Technology
4812 Oak Grove Drive
Pasadena, California

NEW AEROSPACE PRODUCTS



Camera Designed to Photograph Suspicious Vessels

Navy pilot, from the right seat of a Convair SSF ASW aircraft, demonstrates the use of the KT-25A camera designed to record evidence of Russian submarines and transfers operating from American coastlines and other installations. The KT-25A camera, requiring a modified wing camera, has a fast turret mechanism allowing the operator to swing, focus, snap the photo and record at 2 sec. Chicago Aerial Industries, developer of the KT-25A, is producing 1,000 for the Navy. Avionics dome atop the fuselage is passive ECM antenna.

Jet Vane Actuator

Venturi control pit static actuator for guided missiles and powered speed vehicles in production for use as the Ranger space vehicle.

The actuator controls electrically related control and telemetering data elements, and has shaft position control over a range of 360° deg. Driving member is a direct coupled d.c. torque motor. Output torque is 2.5 in.-oz. at full load with under 3 watts input power. The 0.5 in. actuator is 1.75 in. in diameter and 2 in. long. Aeroflex Laboratories Division, 34-06 Skillman Ave., Long Island City, N. Y.



Aircraft Feed Container

Glasco feed container for transport aircraft galley access is used by Kermec. The container, constructed of Douglas Aircraft Corp.'s Aircorin panels, weighs 11 lb. and can carry 240 lb. loads.

The container is welded into Aircorin panels, bonded to a metal frame, and a polyurethane insert with drawer guides is mounted within the box. The door has a flush latch and opens 270 deg. to fold out of the way. Container dimensions are 32 x 29 x 16 in. Vencor A.G., Egg, ZH, Switzerland.





Confidence counts and the airlines count on Sinclair

45% of the aircraft oil used by major scheduled airlines in the United States is supplied by Sinclair. Military jets also count on Sinclair to supply Sinclair Aircraft Oil to lubricate their mighty engines. There is no better proof of reliability.

Sinclair AIRCRAFT OILS



Sinclair Refining Company

Aviation Sales, 600 Fifth Ave., New York 20, N. Y.

BUSINESS FLYING



ZANFLEUR GLACIER, 30,000 ft. above the Swiss coast of Les Diablerets, where a new airport is being built. Aircraft shown here on temporary glacier are Super Pigeon from the Swiss Air Force and a Cessna 441 from the Swiss Air Force.

Swiss 'Glacier' Airport Construction Begun

Les Diablerets, Switzerland—Construction is under way here on what its sponsors term "the world's first glacier airport."

Situated on the approximately 18,000-ft-high Zandfleur glacier, this 1,916-ft-long runway and 1,360-ft-long taxiway sections are being built to serve vacationers and tourists in the Les Diablerets resort region, which borders on the French-Swiss border.

Powered by the Bernese Alps, the Diablerets mountain range to the northwest and to the west by the Diablerets peak, the perpetual ice and general conditions of the Zandfleur glacier are ideal for the establishment of an airport at such an altitude.

When the runways are completed by July-August this summer, the airport will be under the direction of Hermann Gasser of Bern, a Swiss dyne commander and one of the organizers of the plan. He already uses it for the training of student pilots in his glider landing and takeoff technique. (AW Apr. 4, 1960, p. 124) and has made more than 1,000 landings on the unimproved strip thus far.

Beginning this summer a series of regular tourist flights will be introduced between the nearby Reichenbach Airport, and later on several daily commercial plane shuttle services to Zurich and Geneva, and the glacier.

A three-course cable life connecting

U.S. Business & Utility Aircraft Shipments

April, 1961

Make & Model	No. of CofEs	Factory Net Billing
April-September 1961, Cumulative		
Boeing 727	1	\$1,100,000
Boeing 737	1	
Boeing 747	1	
Boeing 767	1	
Boeing 777	1	
Boeing 787	1	
Boeing 797	1	
Boeing 800	1	
Boeing 810	1	
Boeing 820	1	
Boeing 830	1	
Boeing 840	1	
Boeing 850	1	
Boeing 860	1	
Boeing 870	1	
Boeing 880	1	
Boeing 890	1	
Boeing 900	1	
Boeing 910	1	
Boeing 920	1	
Boeing 930	1	
Boeing 940	1	
Boeing 950	1	
Boeing 960	1	
Boeing 970	1	
Boeing 980	1	
Boeing 990	1	
Boeing 1000	1	
Boeing 1010	1	
Boeing 1020	1	
Boeing 1030	1	
Boeing 1040	1	
Boeing 1050	1	
Boeing 1060	1	
Boeing 1070	1	
Boeing 1080	1	
Boeing 1090	1	
Boeing 1100	1	
Boeing 1110	1	
Boeing 1120	1	
Boeing 1130	1	
Boeing 1140	1	
Boeing 1150	1	
Boeing 1160	1	
Boeing 1170	1	
Boeing 1180	1	
Boeing 1190	1	
Boeing 1200	1	
Boeing 1210	1	
Boeing 1220	1	
Boeing 1230	1	
Boeing 1240	1	
Boeing 1250	1	
Boeing 1260	1	
Boeing 1270	1	
Boeing 1280	1	
Boeing 1290	1	
Boeing 1300	1	
Boeing 1310	1	
Boeing 1320	1	
Boeing 1330	1	
Boeing 1340	1	
Boeing 1350	1	
Boeing 1360	1	
Boeing 1370	1	
Boeing 1380	1	
Boeing 1390	1	
Boeing 1400	1	
Boeing 1410	1	
Boeing 1420	1	
Boeing 1430	1	
Boeing 1440	1	
Boeing 1450	1	
Boeing 1460	1	
Boeing 1470	1	
Boeing 1480	1	
Boeing 1490	1	
Boeing 1500	1	
Boeing 1510	1	
Boeing 1520	1	
Boeing 1530	1	
Boeing 1540	1	
Boeing 1550	1	
Boeing 1560	1	
Boeing 1570	1	
Boeing 1580	1	
Boeing 1590	1	
Boeing 1600	1	
Boeing 1610	1	
Boeing 1620	1	
Boeing 1630	1	
Boeing 1640	1	
Boeing 1650	1	
Boeing 1660	1	
Boeing 1670	1	
Boeing 1680	1	
Boeing 1690	1	
Boeing 1700	1	
Boeing 1710	1	
Boeing 1720	1	
Boeing 1730	1	
Boeing 1740	1	
Boeing 1750	1	
Boeing 1760	1	
Boeing 1770	1	
Boeing 1780	1	
Boeing 1790	1	
Boeing 1800	1	
Boeing 1810	1	
Boeing 1820	1	
Boeing 1830	1	
Boeing 1840	1	
Boeing 1850	1	
Boeing 1860	1	
Boeing 1870	1	
Boeing 1880	1	
Boeing 1890	1	
Boeing 1900	1	
Boeing 1910	1	
Boeing 1920	1	
Boeing 1930	1	
Boeing 1940	1	
Boeing 1950	1	
Boeing 1960	1	
Boeing 1970	1	
Boeing 1980	1	
Boeing 1990	1	
Boeing 2000	1	
Boeing 2010	1	
Boeing 2020	1	
Boeing 2030	1	
Boeing 2040	1	
Boeing 2050	1	
Boeing 2060	1	
Boeing 2070	1	
Boeing 2080	1	
Boeing 2090	1	
Boeing 2100	1	
Boeing 2110	1	
Boeing 2120	1	
Boeing 2130	1	
Boeing 2140	1	
Boeing 2150	1	
Boeing 2160	1	
Boeing 2170	1	
Boeing 2180	1	
Boeing 2190	1	
Boeing 2200	1	
Boeing 2210	1	
Boeing 2220	1	
Boeing 2230	1	
Boeing 2240	1	
Boeing 2250	1	
Boeing 2260	1	
Boeing 2270	1	
Boeing 2280	1	
Boeing 2290	1	
Boeing 2300	1	
Boeing 2310	1	
Boeing 2320	1	
Boeing 2330	1	
Boeing 2340	1	
Boeing 2350	1	
Boeing 2360	1	
Boeing 2370	1	
Boeing 2380	1	
Boeing 2390	1	
Boeing 2400	1	
Boeing 2410	1	
Boeing 2420	1	
Boeing 2430	1	
Boeing 2440	1	
Boeing 2450	1	
Boeing 2460	1	
Boeing 2470	1	
Boeing 2480	1	
Boeing 2490	1	
Boeing 2500	1	
Boeing 2510	1	
Boeing 2520	1	
Boeing 2530	1	
Boeing 2540	1	
Boeing 2550	1	
Boeing 2560	1	
Boeing 2570	1	
Boeing 2580	1	
Boeing 2590	1	
Boeing 2600	1	
Boeing 2610	1	
Boeing 2620	1	
Boeing 2630	1	
Boeing 2640	1	
Boeing 2650	1	
Boeing 2660	1	
Boeing 2670	1	
Boeing 2680	1	
Boeing 2690	1	
Boeing 2700	1	
Boeing 2710	1	
Boeing 2720	1	
Boeing 2730	1	
Boeing 2740	1	
Boeing 2750	1	
Boeing 2760	1	
Boeing 2770	1	
Boeing 2780	1	
Boeing 2790	1	
Boeing 2800	1	
Boeing 2810	1	
Boeing 2820	1	
Boeing 2830	1	
Boeing 2840	1	
Boeing 2850	1	
Boeing 2860	1	
Boeing 2870	1	
Boeing 2880	1	
Boeing 2890	1	
Boeing 2900	1	
Boeing 2910	1	
Boeing 2920	1	
Boeing 2930	1	
Boeing 2940	1	
Boeing 2950	1	
Boeing 2960	1	
Boeing 2970	1	
Boeing 2980	1	
Boeing 2990	1	
Boeing 3000	1	
Boeing 3010	1	
Boeing 3020	1	
Boeing 3030	1	
Boeing 3040	1	
Boeing 3050	1	
Boeing 3060	1	
Boeing 3070	1	
Boeing 3080	1	
Boeing 3090	1	
Boeing 3100	1	
Boeing 3110	1	
Boeing 3120	1	
Boeing 3130	1	
Boeing 3140	1	
Boeing 3150	1	
Boeing 3160	1	
Boeing 3170	1	
Boeing 3180	1	
Boeing 3190	1	
Boeing 3200	1	
Boeing 3210	1	
Boeing 3220	1	
Boeing 3230	1	
Boeing 3240	1	
Boeing 3250	1	
Boeing 3260	1	
Boeing 3270	1	
Boeing 3280	1	
Boeing 3290	1	
Boeing 3300	1	
Boeing 3310	1	
Boeing 3320	1	
Boeing 3330	1	
Boeing 3340	1	
Boeing 3350	1	
Boeing 3360	1	
Boeing 3370	1	
Boeing 3380	1	
Boeing 3390	1	
Boeing 3400	1	
Boeing 3410	1	
Boeing 3420	1	
Boeing 3430	1	
Boeing 3440	1	
Boeing 3450	1	
Boeing 3460	1	
Boeing 3470	1	
Boeing 3480	1	
Boeing 3490	1	
Boeing 3500	1	
Boeing 3510	1	
Boeing 3520	1	
Boeing 3530	1	
Boeing 3540	1	
Boeing 3550	1	
Boeing 3560	1	
Boeing 3570	1	
Boeing 3580	1	
Boeing 3590	1	
Boeing 3600	1	
Boeing 3610	1	
Boeing 3620	1	
Boeing 3630	1	
Boeing 3640	1	
Boeing 3650	1	
Boeing 3660	1	
Boeing 3670	1	
Boeing 3680	1	
Boeing 3690	1	
Boeing 3700	1	
Boeing 3710	1	
Boeing 3720	1	
Boeing 3730	1	
Boeing 3740	1	
Boeing 3750	1	
Boeing 3760	1	
Boeing 3770	1	
Boeing 3780	1	
Boeing 3790	1	
Boeing 3800	1	
Boeing 3810	1	
Boeing 3820	1	
Boeing 3830	1	
Boeing 3840	1	
Boeing 3850	1	
Boeing 3860	1	
Boeing 3870	1	
Boeing 3880	1	
Boeing 3890	1	
Boeing 3900	1	
Boeing 3910	1	
Boeing 3920	1	
Boeing 3930	1	
Boeing 3940	1	
Boeing 3950	1	
Boeing 3960	1	
Boeing 3970	1	
Boeing 3980	1	
Boeing 3990	1	
Boeing 4000	1	
Boeing 4010	1	
Boeing 4020	1	
Boeing 4030	1	
Boeing 4040	1	
Boeing 4050	1	
Boeing 4060	1	
Boeing 4070	1	
Boeing 4080	1	
Boeing 4090	1	
Boeing 4100	1	
Boeing 4110	1	
Boeing 4120	1	
Boeing 4130	1	
Boeing 4140	1	
Boeing 4150	1	
Boeing 4160	1	
Boeing 4170	1	
Boeing 4180	1	
Boeing 4190	1	
Boeing 4200	1	
Boeing 4210	1	
Boeing 4220	1	
Boeing 4230	1	
Boeing 4240	1	
Boeing 4250	1	
Boeing 4260	1	
Boeing 4270	1	
Boeing 4280	1	
Boeing 4290	1	
Boeing 4300	1	
Boeing 4310	1	
Boeing 4320	1	
Boeing 4330	1	
Boeing 4340	1	
Boeing 4350	1	
Boeing 4360	1	
Boeing 4370	1	
Boeing 4380	1	
Boeing 4390	1	
Boeing 4400	1	
Boeing 4410	1	
Boeing 4420	1	
Boeing 4430	1	
Boeing 4440	1	
Boeing 4450	1	
Boeing 4460	1	
Boeing 4470	1	
Boeing 4480	1	
Boeing 4490	1	
Boeing 4500	1	
Boeing 4510	1	
Boeing 4520	1	
Boeing 4530	1	
Boeing 4540	1	
Boeing 4550	1	
Boeing 4560	1	
Boeing 4570	1	
Boeing 4580	1	
Boeing 4590	1	
Boeing 4600	1	
Boeing 4610	1	
Boeing 4620	1	
Boeing 4630	1	
Boeing 4640	1	
Boeing 4650	1	
Boeing 4660	1	
Boeing 4670	1	
Boeing 4680	1	
Boeing 4690	1	
Boeing 4700	1	
Boeing 4710	1	
Boeing 4720	1	
Boeing 4730	1	
Boeing 4740	1	
Boeing 4750	1	
Boeing 4760	1	
Boeing 4770	1	
Boeing 4780	1	
Boeing 4790	1	
Boeing 4800	1	
Boeing 4810	1	
Boeing 4820	1	
Boeing 4830	1	
Boeing 4840	1	
Boeing 4850	1	
Boeing 4860	1	
Boeing 4870	1	
Boeing 4880	1	
Boeing 4890	1	
Boeing 4900	1	
Boeing 4910	1	
Boeing 4920	1	
Boeing 4930	1	
Boeing 4940	1	
Boeing 4950	1	
Boeing 4960	1	
Boeing 4970	1	
Boeing 4980	1	
Boeing 4990	1	
Boeing 5000	1	
Boeing 5010	1	
Boeing 5020	1	
Boeing 5030	1	
Boeing 5040	1	
Boeing 5050	1	
Boeing 5060	1	
Boeing 5070	1	
Boeing 5080	1	
Boeing 5090	1	
Boeing 5100	1	
Boeing 5110	1	
Boeing 5120	1	
Boeing 5130	1	
Boeing 5140	1	
Boeing 5150	1	
Boeing 5160	1	
Boeing 5170	1	
Boeing 5180	1	
Boeing 5190	1	
Boeing 5200	1	
Boeing 5210	1	
Boeing 5220	1	
Boeing 5230	1	
Boeing 5240	1	
Boeing 5250	1	
Boeing 5260	1	
Boeing 5270	1	
Boeing 5280	1	
Boeing 5290	1	
Boeing 5300	1	
Boeing 5310	1	
Boeing 5320	1	
Boeing 5330	1	
Boeing 5340	1	
Boeing 5350	1	
Boeing 5360	1	
Boeing 5370	1	
Boeing 5380	1	
Boeing 5390	1	
Boeing 5400	1	
Boeing 5410	1	
Boeing 5420	1	
Boeing 5430	1	
Boeing 5440	1	
Boeing 5450	1	
Boeing 5460	1	
Boeing 5470		

SOLID RIVET STRENGTH WITH BLIND RIVETS

**CHERRYLOCK RIVETS for Your
Difficult Solid Rivet Applications**

BULBED CHERRYLOCK

**ONLY THE BULBED CHERRYLOCK RIVET
GIVES YOU ALL THESE ADVANTAGES**

Mechanically Locked Joints • Buck Resists
No Stem Trimming • Positive Clamp-Up •
Full Grip Range • Complete Hole Fill • Min-
imum Blind Side Clearance • Positive Visual
Inspection (Grip Length Marked on Head)



Ideal for Thin Sheet and
Double-Drift Applications—
extremely large filled head

The Bulbed Cherrylock® offers a blind rivet that installs and performs like a solid rivet. Bulbed Cherrylock Rivets will quickly where you are now using solid rivets, offering higher joint strength with greatly increased joint reliability under critical loading conditions—fatigue, shock and sonic vibration.

New Cherrylock rivets give you a blind rivet that can be used in expensive forgings as well as for joining and attaching sheets and components.

For technical data on Cherrylock Rivets, write Cherry Rivet Division, Townsend Company, Box 21572N, Santa Ana, California.

* Patent Pending

CHERRY RIVET DIVISION
SANTA ANA, CALIFORNIA

Townsend Company

ESTABLISHED 1914 • HAVERTY FALLS, PA.

In Complete Fabrication & Bulbed Manufacturing Capabilities, United, Commercial, Chemical

the Zenithers planes with the remaining Lee Dobbins area in the sky also is planned and depending upon the initial popularity achieved by the first two projects, a third hotel, open to guests throughout the year, may be built at a later date.

Two independent, separately-run companies have been formed for both the airport and cable life companies. They are receiving support of the central authorities although financing is being provided by private investors.

Business Plane Sales Off From 1960 High

Piper Aircraft Corp. deliveries for June, totaled 290 business and utility aircraft valued at \$2,790,834, which compares with 235 units shipped in the same month last year having a total net book value of \$5,452,659.

Piper factory shipments for the first six months of 1961 totaled 1,459 units, having a total net factory billings value of \$16,947,514. In the same period last year the manufacturer shipped 1,477 aircraft valued at \$23,979,006. 1960 business—12 PA-15-50 Super Cubs, 129 PA-12 Cubs, 6 PA-21-160 Aqueducts, 19 PA-23-240 Arrows, 9 PA-26-180 Comanches, 24 PA-24-250 Comanches, 17 PA-25-150 Pipers and 16 PA-25 Cherokees.

Total sales of \$27,375,248 have been recorded by Beech Aircraft Corp. Wichita, Kan., for the first nine months of its current fiscal year with net earnings after taxes amounting to \$3,743,753. Earnings equalled 64 cents per share.

Sales for the period were down from the same period last year when Beech reported \$28,555,571. Earnings were down from last year's same period \$4,117,695, which equalled \$1.40 per share. The company's board of directors announced payment of a regular 15-cent quarterly dividend payable Aug. 2 to holders of record July 21, pointing out that shareholders in fiscal 1961 will receive an increase in dividend of more than 12% over last year considering the 1-4 stock split of last November.

Sales of business and utility aircraft for the first nine months of 1961 totaled \$12,314,161. Although this is off about 11% from last year's record high of \$13,761,489, sales were up 25% from the firm's second highest year—1959—and more noticeably higher than previous years, sales for the current period. With sales for the first nine months of the year totaled \$21,851,656 compared with \$14,541,054 for the same period last year. This, however, was in line with industry sales. In comparison officials last fall in view of the plane

out of McDonnell F441, Lockheed F-104 and Cessna R-330 subcontracts between are that Beech will assist in production of some \$25 million in subcontracts for fiscal 1961.

Particularly noteworthy is the sharp gain in export sales—these were up 45% over the same period last year and two European distributors have achieved first and second place in distributorship sales for the entire organization, including the domestic sales organization.

Soviet Amur Sailplane Testing Is Completed

Moscow—New Russian single-place, ultralight, all-metal Amur sailplane, has completed government tests. Experimental models of the standard-size, diamond-shape craft, which is only 190 lb. (49 lb.), are said to have cost less than Soviet aerial gliders now in quantity production.

During final tests, an Amur was lifted into the air by a cable of 1,066 meters by an Mi-6 helicopter. When the tow cable was released, the test pilot reportedly brought the Amur out of its tail spin and put it into a dive with a last of only 100 meters altitude.

PRIVATE LINES

Field Aviation Co., Ltd., has been appointed exclusive Beech Aircraft Corp. representative in the Canadian government. Field Aviation is the distributor of the Beech line for all of Canada west of the Ontario-Quebec border.

Aukausis, a subsidiary of Kinross Aircraft Corp. will start a flight service facility, serving an estimated \$100,000 in business. Field, Conn. Facility will do a 20,000 sq. ft. hangar and facilities for sales, service and repair.

Shaw Engineering Co., builder of the Shima 2150-A, is planning to further expand into the light aircraft market. Already built is a prototype model which will sell for less than the standard 2150-A priced at \$5,000 (AUG. 12, p. 119). It will be cheaper than the 2150-A primarily because of the elimination of flap and some extra. Also an advanced design, it is a two-place aircraft similar in configuration to the 2150-A which probably will be powered by a 250-hp engine.

Extra 240 gal. of fuel is available for the Comman Calcuttina via installation of additional 800 lb. internal fuel tanks in each wing using panel on covering the range of the Calcuttina to 3,000 stat. mi. plus 45-min. reserve.

MACH 14.7 DATA

The graph below presents calibration data at two stations downstream of the nozzle in the new *FluidDyne* Hypersonic Flight Simulation Facility.



**THIS NEW *FluidDyne*
FACILITY CAN PROVIDE YOU
WITH TEST CONDITIONS
AS FOLLOWS:**

Mach No. 7.0 to 18
Stagnation Pressure To 2800 psi
Stagnation Temperature To 4000° K
Free Time In excess of 1 minute
Free Medium Air

Nike Zeus, Saturn, and Dynasore programs have been run or are scheduled.

FluidDyne has the experience and facilities to help you with research, evaluation, or testing programs in solution, heat transfer, force measurement, or heat heating. Inquire now for detailed information about your specific requirements.

FLUIDDYNE
ENGINEERING CORP.

3744 Mayfield Blvd., Minneapolis 16, Minn.
W50 MF-102 • Phone Library 5-2701

We hope you will prefer *FluidDyne* as a good place to work. Excellent opportunities for advancement, growth, and challenge. Write or phone and get on the nature of your address and facilities.



JET TEST BOAT. Boeing jet powered research hydroplane, capable of speeds up to 100 knots, in process addition to floating equipment devoted to advancing boat knowledge. Aero-Jet will be used to test experimental hydrofoil designs. Boat could be

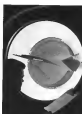
suspended between girders from structure which controls action of afloat being pushed through water. Three hydrodynamic design studies are typical of expanding Boeing efforts in marine field, which include building a hydrofoil patrol craft for U.S. Navy.

Capability has many faces at Boeing



CARGO-JET. Boeing C-41 cargo jet, one of 30 ordered by the Military Air Transport Service, has already been delivered. These 30 C-41s will provide MATS with much capability space lost by 100 propeller driven transports.

SUPERSONIC Learjet model being tested on Boeing wind tunnel. Boeing is providing subsonic tests in supersonic transport research facility which would be able to fly from New York to London in less than three hours.



SPACE GLIDER. Delivery of Space Shuttle S-5 Air Force manned space glider designed to risk at sub-orbit, then test for orbit atmosphere. It has no solid pilot-controlled landing. Space Shuttle is being developed by U.S. Air Force in cooperation with NASA, with Boeing in prime contractor for both the system and the glider.

BOEING

LEWIS

SELECTOR SWITCHES

for

Resistance Thermometers
Thermocouple Thermometers

THERMOCOUPLE SWITCHES



Flanged
Dials
In 2 inch
2 inch
4 inch dia.

Engineered to give years of service in test work as well as in permanent installations, LEWIS switches have heavy, low-wear, zinc contacts, positive detent action and sturdy terminals for easy wiring.

The case is splash proof and dust tight, of close fitting bakelite. Heavy black-anodized aluminum endring leads are used to join the stainless steel shaft supporting the rotating brushes.

RESISTANCE BUILD SWITCHES

A complete line of the same construction except that they are fitted with a common terminal ring for direct wire bulb connections.

THE 9S SERIES THE SPACE SAVERS

FOR AIRCRAFT REFERENCE
INSTRUMENTS

Small, sturdy steel-cased switches 1 1/2 inches in diameter. 2 1/2 inch radius metal shell length one hole mounting with 1/8 32 NS-D4 standard back. 1 1/2" dia. dia. Designed especially for mounting low or above non-venter transparent deviation to one instrument, now flying in the modern jet.

Write for our descriptive bulletin on Reference Switches

THE LEWIS ENGINEERING CO.

Specialists in Resistance Thermometer
Thermocouple, CONNECTING

FINANCIAL

New Offerings

Geosyne Company of America, Inc., St. Louis, N.E., engaged in the design, engineering and manufacturing of coastal design & engineering having two notes mentioned one above the other on a single axis and rotating in opposite directions, the company's business is currently expanding upon new customers, the Department of the Navy, which accounts for all of its business, primarily in connection with its Division: Anti-Submarine Helicopter program. Offering is \$1,140,000 of convertible subordinated debentures, due 1975, (with attached 6 1/2% interest) and 90,000 shares of common stock, for public sale in units consisting of 549 of debentures (with a warrant to purchase one common share) and five common shares (of the 90,000 common shares, 34,800 are outstanding and are to be offered with the units by Peter J. Papadimos, president and principal stockholder. Interest rate of the debentures, payable at the rate of the units and maturing time to be supplied by prospectus.

Proceeds from the sale will be used for the redemption of preferred stock for the construction of an engineering office building and a flight test hangar together with concrete aprons for the purchase of machinery and equipment to be used for the fabrication of helicopter components and for the purchase of land and buildings, to replace working capital used for plant expansion and purchase of equipment since May, 1971, the balance will be added to working capital to finance continued sales in projects in progress.

Electronic Capital Corp., San Diego, Calif., located under the Small Business Investment Act of 1958 and registered in a closed-end non-dividend management investment company under the Investment Company Act of 1940, the company provides long-term investment capital and management services to small business concerns principally in the electronics field. Offering is \$11,467 shares of common stock, for subscription by common stockholders at the rate of one new share for each three shares held, record date, subscription price and underwriting basis to be supplied by prospectus. Proceeds will be used to make additional investments in small business concerns, principally in concerns not previously represented in the company's portfolio.

Firth Dickinson, Inc., Princeton, N. J., engaged in the design, development, manufacture and sale of precision in-

20% STRONGER LIGHTER HONEYCOMB CORE OPENS NEW DESIGN HORIZONS

Hexcel's new 5056 aluminum alloy honeycomb core is at least 20% stronger than any other core of the same weight. This important advance brings two major benefits to the designer and user of honeycomb structures. First, it allows a further weight reduction in present honeycomb uses. Second, and perhaps of greater importance, it opens a wide new range of design applications where the increased strength of 5056 alloy is essential.



New 5056 alloy contains the same metals as Hexcel's 5052, with a significant increase in magnesium content. Current tests indicate that 5056 has the highest strength-to-weight ratio of any aluminum honeycomb ever made. Hexcel 5056 honeycomb offers an immediate solution to design problems of weight and strength in the aircraft, space vehicle and missile fields, and promises new applications in electronics, construction, and packaging.

For detailed test results and complete data on Hexcel 5056 Honeycomb, write Dept. E-7

HEXCEL PRODUCTS INC.

Supplies lightweight materials for industry
2358 Fourth Street
Beverly Hills, California
Old Post Road, Haver de Grace, Md.

DETAILED SALE:

The advertising rate is \$44.00 per inch for 40% advertising appearing in other than our central boxes. Contact rates on request.

AN ADVERTISING INDEX is maintained to link advertiser to one column 8 columns—40 inches—on page.

Send NEW Ads or Inquiries to Classified Ads: Box of Aviation Week, P.O. Box 10, N.Y. 34 N.Y.

UNEMPLOYED DATA:

30/30 - 1 day, including 2 days. To receive advance payment send \$10.00. Payment within 10 days.

RECEIVED: 30/30 - 1 day or 10 days.

SEE BUSINESS section on top left additional to unhighlighted ads.

FOR SALE DOUGLAS DC-6A/B AIRPLANE

LONG RANGE OVERWATER
HIGHER RATING

Complete inventory of DC-6A/B space parts.

- 1 Bush DOUGLAS C-41E
AIRCRAFT & Space Parts
- 2 Bush C-41E AIRCRAFT

THANKS CANADIAN AIRLINES

Boeing 707 New York International
Airport

Location 30, New York
Tel. 400-2115

Write to: Phone John P. Anderson, And. N.Y.

WHERE TO BUY

Featuring additional
products, specialties
& services for
the aviation field

WEEKLY AVIATION ADVERTISING

Aviation Advertisers: 100% of all ads placed
in this section are placed in the
aviation field.

Weekly air parts ad. (100% of all ads placed
in this section are placed in the
aviation field.)

MANUFACTURERS OF PRODUCTION EQUIPMENT

SEARCHLIGHT Equipment Locating Service

NO COST OR OBLIGATION

This service is aimed at helping you, the reader of "SEARCHLIGHT", to locate Service men and used aviation equipment and components not currently advertised. (This service is for USER-SUPPLY only.)

How to use: Check the dealer ads to see if what you want is not currently advertised. If not, send us the specifications of the equipment wanted on the coupon below, or on your own company letterhead to:

Searchlight Equipment
Locating Service

c/o AVIATION WEEK

P.O. Box 12, N.Y. 34, N.Y.

Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

Searchlight Equipment Locating Service

c/o AVIATION WEEK

P.O. Box 12, N.Y. 34, N.Y.

Please send us details of the equipment you need.

Name (Last, First, Middle Initial)

Title

Company

Street

City

State

Zip

Phone

Telex

Radio

Teletype

Other

Signature

Date

Enclosure

At Your Service...

The Searchlight Section is at your service for bringing business leads or "opportunities" to the attention of men associated in executive, management, sales and responsible technical engineering and operating capacities with the industry served by McGraw-Hill publications.

IN ALL INTERESTS OF AVIATION

If You're Important, you either read

AVIATION WEEK

or you advertise in it, or both

ADVERTISERS IN THIS ISSUE

AVIATION WEEK, JULY 31, 1961

ALCOHOL CORPORATION	50	AVIATION WEEK AND SPACE TECHNOLOGY	10-12
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10

ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10

ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10

ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10

ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10

ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10

ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10

ALCOHOL CORPORATION, DEFENSE & SPACE SYSTEMS	50	BAIRD & BIRD, INC.	10
--	----	--------------------	----

PROBLEMATIC RECREATIONS 77



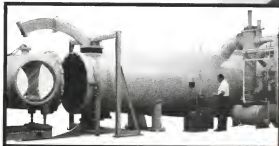
Can 1961 be represented in the case of a cube and a fourth power?

—Continued

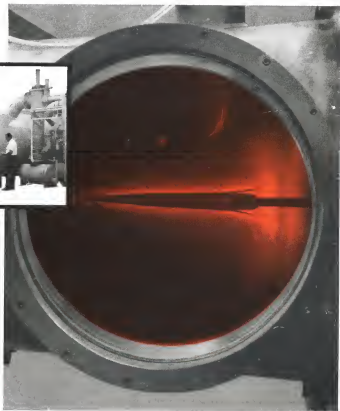
Developing and producing power sources is the business of our Electron Tube Division, Model L-3513 being a recent example. This portable power source provides from 320 to 640 watts of CW or modulated RF microwave power in the 150 mc to 100 S band range. Works well in the field for high power testing of microwave components and systems and as the RF driver for high power microwave amplifier tubes. For more line points, write: Marketing Dept., Electron Tube Division, San Carlos, Calif.

POWER TO LAST WEEK'S PROBLEM: The physicists spent 33 shillings, the engineers also spent 33 shillings, the production managers spent 41 shillings and the computerists spent 21 shillings.

WITON INDUSTRIES, INC.
Beverly Hills, California



**THE
EDGE
OF SPACE
IS IN
ST. LOUIS**



Years before McDonnell space vehicles reach the testing centers at Canaveral, designs are subjected to the severe environment existing at the edge of space. At McDonnell's Hypervelocity Impulse Tunnel in St. Louis the combined electrical impulse power of the Grand Coulee and Hoover Dams breaks loose into the confines of a cannon-like funnel and subjects space vehicle models to simulated altitudes up to 60 miles, 14,000° temperatures and speeds up to Mach 27.

From McDonnell's unduplicated aerospace facilities such as this come innovations; innovations that have characterized McDonnell

products through the Company's 22-year history; innovations from forward thinking engineers who seek to shape air and space vehicles to their unique environmental requirements, rather than stretch existing designs to achieve marginal success. In the development of these advanced air and space systems, opportunities exist for advanced degree physicists, scientists and electronic management engineers anxious to take broad strides across the "State of the Art" barrier. Your inquiry is invited.

Write R. F. Kaletta, Engineering Employment
McDonnell Aircraft, St. Louis, Mo.

MCDONNELL

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

*Phantom II and F-101 Fighter and Attack Aircraft •
Project Mercury and Aeroballistic Spacecraft • Talos Airframes and Propulsion Systems •
Quail Decoy Missiles • Rotorcraft • Electronics Systems • Automation*

MCDONNELL AIRCRAFT • ST. LOUIS